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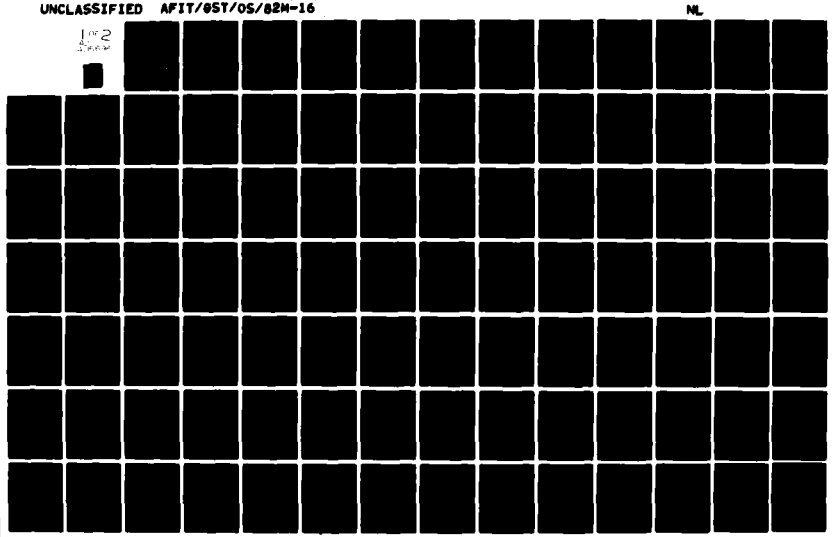

AFIT/GST/OS/82M-16

A MODEL TO EVALUATE F-4E SQUADRON SCHEDULED SORTIE RATES AND PILOT GRADUATED COMBAT CAPABILITY STATUS

THESIS

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THESIS

Presented to the Faculty of the School of Engineering
of the Air Force Institute of Technology
Air University
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science

by

John P. Wood
Capt USAF

Graduate Strategic and Tactical Sciences

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Preface

Tactical Air Command outlines an aircrew training program referred to as the Graduated Combat Capability. Within Tactical Air Command, Tactical Figher Wings are responsible for training these aircrews under that program. At the same time, they are also responsible for maintaining their fleets at prescribed readiness levels. The process of managing both aircrews and aircraft is through scheduling. This thesis presents a model that determines a scheduled sortie rate in order to obtain a predetermined training level for one F-4E squadron.

I would like to thank Lt Col Tom Clark, my faculty advisor, for his assistance throughout this research effort.

Additionally, I wish to thank my wife, Yvonne, without whose patience and understanding this project would have been unbearable.

— John P. Wood

Contents

List of Figures

List of Tables

Abstract

During the course of a six-month training period, wing schedulers are tasked with revising their planned flying schedules. The objective of this research was to build an interactive model that would determine a sortie rate to allow one F-4E squadron to maintain a predetermined level of training.

A model of the flying operations of the squadron was constructed using the Q-GERT simulation language. This model provided the data base for effective sorties flown by experienced and inexperienced pilots. Regression lines were constructed for both classes of pilots with attrition being the independent variable and effective sorties being the dependent variable. The regression coefficients were then incorporated into a model to evaluate sortie rates. The sortie rate obtained from the model is one that will allow the squadron to maintain at least the desired training level.

Although the squadron modeled in this project is not a real one, the approach presented could be used for actual fighter squadrons to help determine their projected daily sortie rates.

A MODEL TO EVALUATE F-4E SQUADRON SCHEDULED SORTIE RATES AND PILOT GRADUATED COMBAT CAPABILITY STATUS

I Introduction

Background

In order for Tactical Air Command (TAC) to fulfill its duties in the achievement of national objectives, it must insure that its aircrews receive proper levels of training. A significant portion of this training of aircrews is accomplished on airborne missions. Each Tactical Fighter Wing within TAC is assigned a primary mission to fly. These primary missions are consistent with the type aircraft possessed by a wing. A primary mission is comprised of many tasks, and the degree of difficulty and training complexity for each task varies. Therefore, for each primary mission there must be a specified amount of flying training to be provided. TAC acknowledges that due to resource limitations, units may not be fully trained to their weapon system's maximum potential (Ref 1:1-1).

TAC Manual 51-50, Volume I, outlines the flying training program known as the Graduated Combat Capability (GCC) (Ref 1:1-1). GCC is a three level approach to

managing training requirements to available and requested resources. This approach recognizes that increased capability requires corresponding increases in training. The three levels of GCC are defined as:

1. Level A--This is the basic mission-ready standard. It reflects the minimum level to which a crew must be trained to perform the unit's primary mission.

2. Level B--The additional training required to increase proficiency, lower crew/aircraft attrition, and increase the capability to accomplish the unit's full tasking. Tasking in this level should normally be within the sortie generation capability of the unit.

3. Level C--This level represents the complete training program for the unit based upon Major Air Command tasking. Tasking at this level is normally beyond the sortie generation capability of the unit.

The level of sorties required for the aircrews of an F-4E squadron are listed in Table I. The two types of sorties available are GCC and collateral. A GCC sortie is defined as one within the unit's tasking such as Air-to-Ground gunnery or Air Combat Training. A collateral sortie would consist of a cross-country flight, an instrument navigation flight, or other nonessential flights. The number of collateral sorties allowed for each level is based upon basic aircraft currency requirements that normally could not be completed in conjunction with a GCC

TABLE I

GCC TABLE

	Level A		Level B		Level C	
Pilot	GCC	Total	GCC	Total	GCC	Total
Experienced Pilot	34	43	53	64	69	82
Inexperienced Pilot	41	51	62	74	80	94

Note: Sortie totals listed for a pilot at a particular level are the minimum number needed to maintain that level of training. The difference between total sorties for a pilot at a level and the respective GCC number of sorties can be made up with collateral sorties or they can all be GCC sorties. For example, an inexperienced pilot at level A with 51 total sorties can only have 10 collateral sorties; the remaining 41 must all be GCC sorties.

sortie. The two types of pilots listed are classified as experienced or inexperienced and are based upon accumulated flight time in the assigned aircraft. The sortie totals are requirements for a six-month training period and a pilot must achieve at least level A or he will become non-mission ready. If a unit has too many non-mission ready pilots, then the unit itself becomes non-mission ready and unable to be that instrument of national power used in support of the achievement of national objectives (Ref 3:1-1).

The process of managing aircraft and aircrews is through scheduling. At the beginning of a six-month training period, a scheduled rate of daily sorties to achieve a

particular GCC level for the wing is derived depending upon the capabilities of operations and maintenance, and includes combined attrition. The schedule of daily sortie rates is normally planned to allow the unit to maintain GCC level B. These schedules must include attrition factors to account for lost sorties. The attrition factors use historical averages of lost sorties due to weather, maintenance, operations, directions from Higher Headquarters, and "other." The attrition factors are determined on a monthly, quarterly, and semi-annual basis.

The accuracy of the scheduled sortie rate is important to wing supervisors in the overall management of the flying program. Flying hour allocations from the Major Air Command are tied directly to fiscal allocations. A wing must be able to train its aircrews adequately within the hours allocated and the scheduled sortie rate can be used as a guide for this. The scheduled sortie rate can also be used as a planning factor for maintenance, fuel, and supply requirements.

A current method for determining the six-month scheduled rate of daily sorties is shown in Table II. This table determines a daily sortie rate for a squadron of 24 pilots (12 experienced, 12 inexperienced) to achieve GCC level B at the end of the training period. The level B totals from Table I are multiplied by the number of pilots in each respective class to determine a sortie subtotal

TABLE II

SEMI-ANNUAL SCHEDULED SORTIE RATE

12 Experienced Pilots	x	64 sorties	768
12 Inexperienced Pilots	x	74 sorties	+188
Sobtotals less Attrition			1656
Subtotal x 15% Attrition			+248.4
Total Sorties			1904.4
Scheduled Fly Days			120
Daily Scheduled Rate			15.77
			≃ 16.0

less attrition. This subtotal is then multiplied by the semi-annual attrition figure to account for predicted lost sorties. The subtotal is then added to the lost sorties to arrive at the total number of flights to be scheduled for the half. This total number of scheduled flights is then divided by the number of days to fly during the six-month training period to arrive at the daily scheduled sortie rate. This procedure is at best a guess for determining the six-month training period schedule since it does not account for the difference that exists between the classes of pilots to fly GCC sorties. This inadequacy results from the differing conditional probabilities between the classes of pilots to fly the scheduled sorties. Also, an inadequacy exists in this approach due to the way

aircraft are actually scheduled to fly. F-4 aircraft on training missions are usually scheduled in formations of two, three, or four; and the number of experienced and inexperienced pilots within those flights can vary. The method shown above does not include the manner in which aircraft are scheduled nor does it include the conditional probabilities for GCC sorties. For a particular number of sorties scheduled for a given day, the actual number of GCC sorties flown will vary due to attrition and the conditional probabilities.

During the course of the training plan many different events can occur that can disrupt the planned schedule. When these events occur, the wing schedulers must determine a revised schedule. These revised schedules are more involved than the initial one since current pilot GCC training status must be included. Also, the desired level of training for the unit might even be changed, which would result in a revision. These revisions are currently done in the same manner as previously discussed and are not accurate predictions. What a scheduler needs is a method of determining the least number of scheduled sorties needed to allow the wing to achieve its particular predetermined GCC level. If the desired GCC level is level B, and this level can be reached at 18 sorties per day, then 18 sorties per day should be scheduled and no more. This is true because the maintenance and parts required for

those additional sorties could be better utilized. More effective maintenance could be performed by repairing broken systems and clearing delayed discrepancies rather than flying nonessential additional sorties. The net effect of flying the minimum required sorties is having a better fleet of aircraft and aircrews trained at the desired level. Also of interest in minimizing sorties is the conservation of jet fuel since its costs have risen drastically in the past decade. It is apparent that in scheduling sorties, more is not always better than less, if the lesser amount fulfills the requirements of the mission.

Problem Statement

In a Tactical Fighter Wing, supervisors are tasked with revising their planned flying schedules. These revisions can be minimal as in the loss of several days flying due to severe weather, or they can be drastic such as an extended grounding of a fleet for safety reasons. These revisions of the planned schedule involve calculating projected daily sortie rates in order for aircrews to maintain their GCC levels. These sortie rates should be accurate and encompass the particular flying characteristics of the wing in doing this. To date, there is no model available at a TAC Wing Headquarters that will allow a

revision of these schedules based upon its current pilot GCC training status.

Objectives

The objective of this research was to build an interactive model that would allow the revision of one F-4E squadron's flying schedule during a six-month training period to help maintain its pilot's GCC status. This interactive approach is unique as it does not currently exist. It will also provide the scheduler with a more efficient and accurate method to revise his schedules. By efficient, the scheduler could not only save time in his calculations, but the sortie rate selected would be the most efficient for the wing. The flying schedule is defined as the number of scheduled sorties to be flown daily and will adhere to established maintenance constraints. To obtain this objective, three subobjectives were determined necessary. First, a model to capture and simulate an F-4E squadron's particular flight operations was needed to generate sortie data. Simulation was chosen because it is the process of modeling a real system to obtain understanding of that system, and to use that understanding to help predict the performance of the system in the future. Second, the sortie data generated from the simulation needed to be analyzed. Third, the analyzed data needed to be used in

building the interactive model. Completion of this last subobjective fulfilled the main objective.

Methodology

A diagram of the methodology used in this thesis is presented in Figure 1. This nine-step methodology served two purposes during this research effort. It was initially mapped as a flow diagram to outline the research. It subsequently was used to channel and direct the research.

The first step was to define the problem and then to determine the objective. The components of this first step were previously discussed in the problem statement and objectives section of this chapter.

The second step was to study and describe the system and to do this the systems science approach was utilized (Ref 7:297). This holistic approach begins by viewing the organization in question as a system which consists of a set of objects with relationships between the objects and their environment. To understand the system a conceptual model is constructed beginning with the comprehension of the basic elements, their relationships, and the logic of the system. This model is further described through analysis and measurement whereby changes of state in the system's elements are qualified.

The third step involved the design of the experiment and was extremely important since it formed the basis

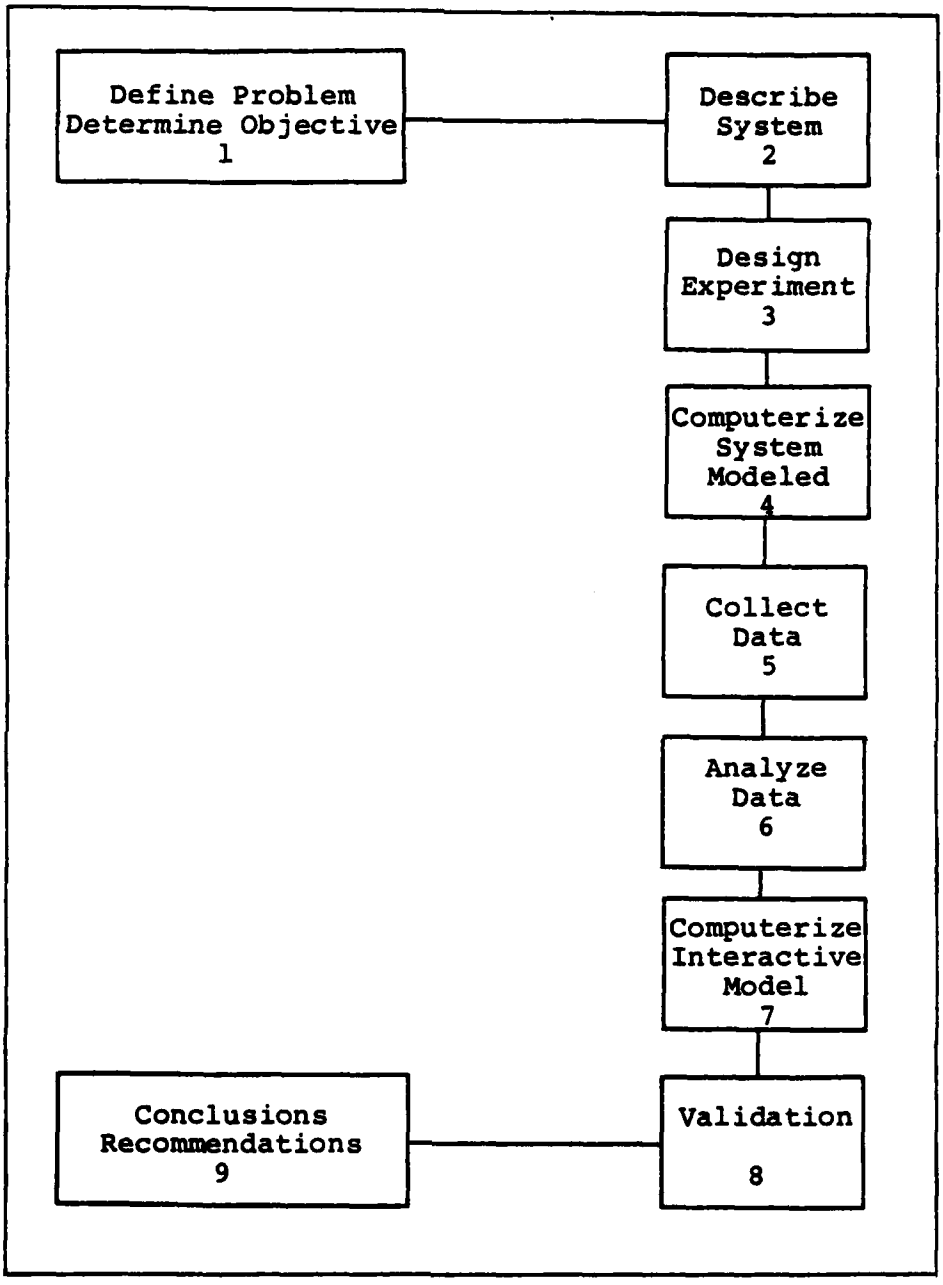

Fig. 1. Thesis Methodology

for the remaining steps of the methodology. The design of a simulation experiment should be approached systematically, just as in any other design problem. A three-step approach to the experimental design was used in this thesis. The steps are (Ref 4:151):

1. Structural Model design
2. Functional Model design
3. Experimental Model design

The structural model consists of factors and levels of factors; it basically determines what is to be modeled. The functional or simulation model determines how the factors will be modeled. The experimental model determines how the results will be analyzed. From step 2 it was determined that attrition and scheduled sorties were to be factors included in the structural model. To model these factors at fixed levels the Q-GERT simulation language was chosen. Q-GERT was chosen as it can adequately model the flying operations of an F-4E squadron. Its structure allows the various components and activities involved to be segmented and allows for user related data collection. For particular scheduled sortie and attrition levels, GCC sortie data for experienced and inexperienced pilots can be collected. Also, this segmentation could allow additional studies to be conducted on F-4E squadron operations, particularly those involving queueing. The experimental model chosen was linear regression. This was done to

determine if for both classes of pilots, linear relationships did exist between attrition rates and effective GCC sorties, given fixed scheduled sortie rates. If so, these regression lines could be incorporated into an interactive model to revise scheduled sortie rates.

Step 4 involved the computerization of the system modeled and was a direct result of the previous three steps. It was an iterative process of refining the system modeled.

After the simulation model was programmed, it was run and data was collected for step 5. On step 6, to analyze the data according to the experimental model, the Statistical Package for the Social Sciences (SPSS) was used. Once the regression lines were obtained, then additional analysis of the lines was conducted. In step 7, the analyzed regression lines were incorporated into the interactive model to satisfy the objective for the thesis.

The validation process of step 8 incorporates all of the previous steps. This process involves evaluating the ability of a model to accurately describe the true behavior of the system modeled. This step also plays an important part of the last step which is to draw conclusions and make recommendations.

Overview

The remainder of this thesis explains the modeling effort, the analysis of results, and the conclusions and

recommenations. Chapter II presents the conceptual model, components, and structural model of the simulation. Chapter III details the functional, or simulation model. In Chapter IV, the collection of the data and the experimental model are discussed; in Chapter V, the analysis of the data is presented. In Chapter VI, the analyzed data is incorporated into the model to determine minimum sortie rates. In Chapter VII, the discussion of verification and validation is presented while Chapter VIII presents the conclusions and recommendations. Chapter IX includes recommended areas for follow-on study.

II System Structure

As previously discussed in the methodology, once the problem and objective have been determined, then the system must be studied and described. The systems science approach to understanding and describing the system begins with the conceptual model of the basic elements and their relationships. As shown in Figure 2, this first level of conceptualization gives an understanding of what is involved, but is not very informative. Focusing on the environment in greater detail as shown in level 2, the important sectors of the environment are identified. These involve the directions and guidance from TAC, the abilities and limitations of maintenance; the F-4 flight operations. The third level involves a further elaboration of flight operations which includes the time schedule of operations, the number of sorties placed on that time schedule, and the attrition of those sorties. It is at this third level that the pertinent components, variables, and parameters can be determined.

After the system has been described, the first step in experimental design is taken in determining the structural model. The structural model is described by and is a function of (Ref 4:152):

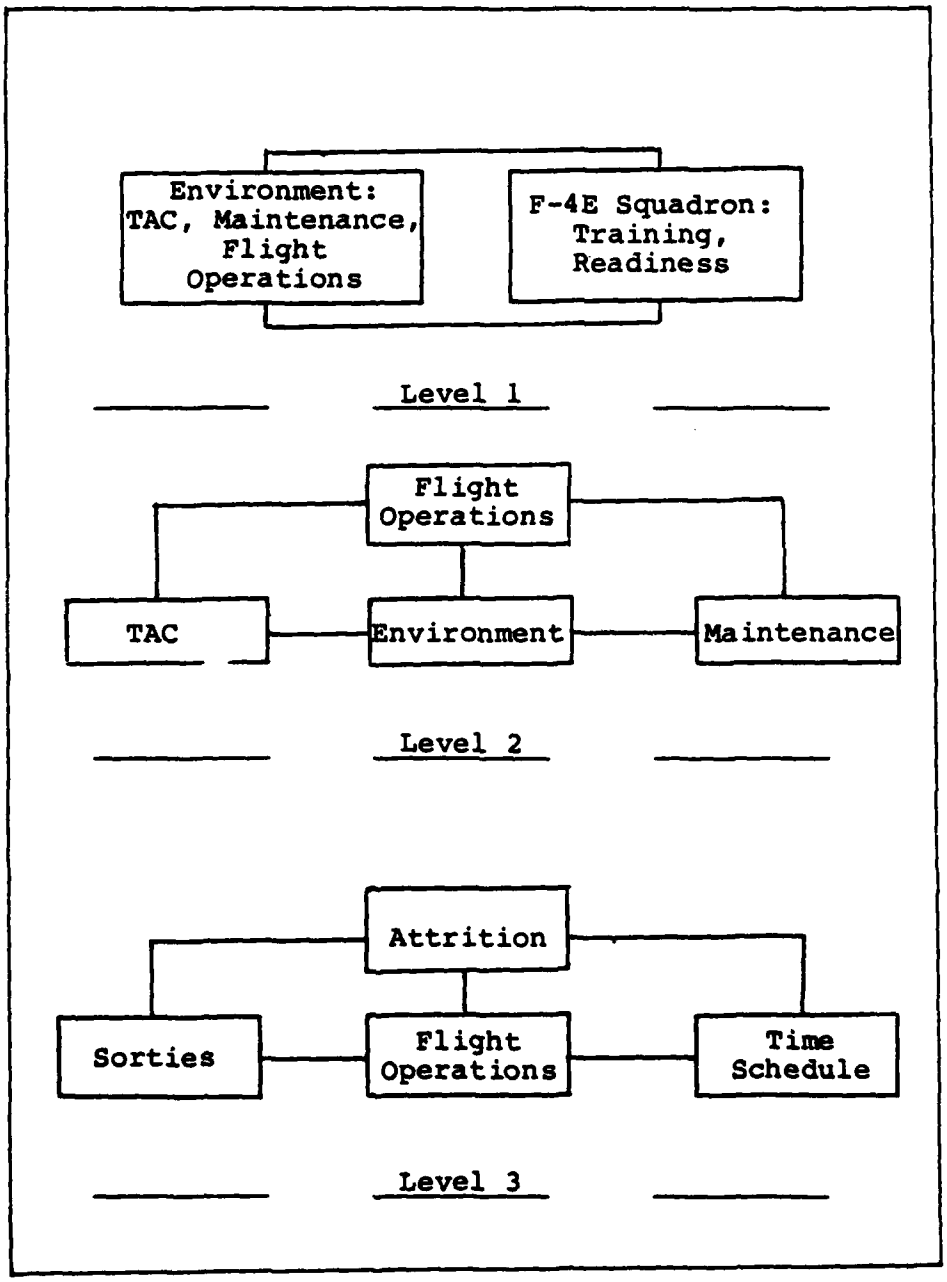

Fig. 2. Systems Science Conceptual Model

1. The number of factors;

2. The number of levels of each factor.

The factors and levels should be determined from the objectives of the experiment. This chapter presents the conceptual model, components, and structural design of the system modeled.

Squadron Structure

The F-4E squadron modeled and the base of assignment are fictitious. The squadron manning and its operations are, however, quite realistic. Data and framework for the system were obtained from TAC, CONUS F-4E units, and the personal F-4 experience of the author. The squadron (Table III) is comprised of an equal mix of experienced and inexperienced pilots; all of whom are mission-ready with no upgrade training required. To be mission-ready a pilot must have achieved a GCC level from the previous training period and be currently qualified for proficiency in the basic aircraft. This provides for all sorties flown to be counted toward GCC status.

TABLE III

F-4E SQUADRON STRUCTURE

Pilots	Status
Experienced (12 total)	Mission-Ready
Inexperienced (12 total)	Mission-Ready

Scheduled Flight Operations

All sorties are scheduled in formations of two with an experienced pilot as the flight lead and an inexperienced pilot as the wingman. Typical daily schedules are listed in Figure 3. As seen in the 18 sortie/day schedule, each formation of two sorties is depicted as a horizontal line extending for 1 hour and twenty minutes (1+20). Starting from 0 hours and moving horizontally along the first line, the flight and ground operations of the first formation are depicted. At 1+00, the first formation takes off; and 2+20 it lands and stays on the ground for an additional 1+20 before the next scheduled takeoff at 3+40. While on the ground, maintenance crews ready the aircraft for two more sorties (turnaround). The first two-ship is scheduled for four flights with three turnarounds. The second two-ship is scheduled for three flights with two turnarounds; the third two-ship is scheduled for two flights with one turnaround. This particular 18 sortie/day schedule for three primary two-ships (six-sorties) is known as "6 turn 6 turn 4 turn 2." All of the schedules listed in Figure 1 employ the scheduling technique of built-in programmed attrition of aircraft as the day progresses. Normally, additional dedicated aircraft act as spares for the primary aircraft. Although the squadron may possess eighteen aircraft, the number dedicated to the flying schedule will be appreciably less

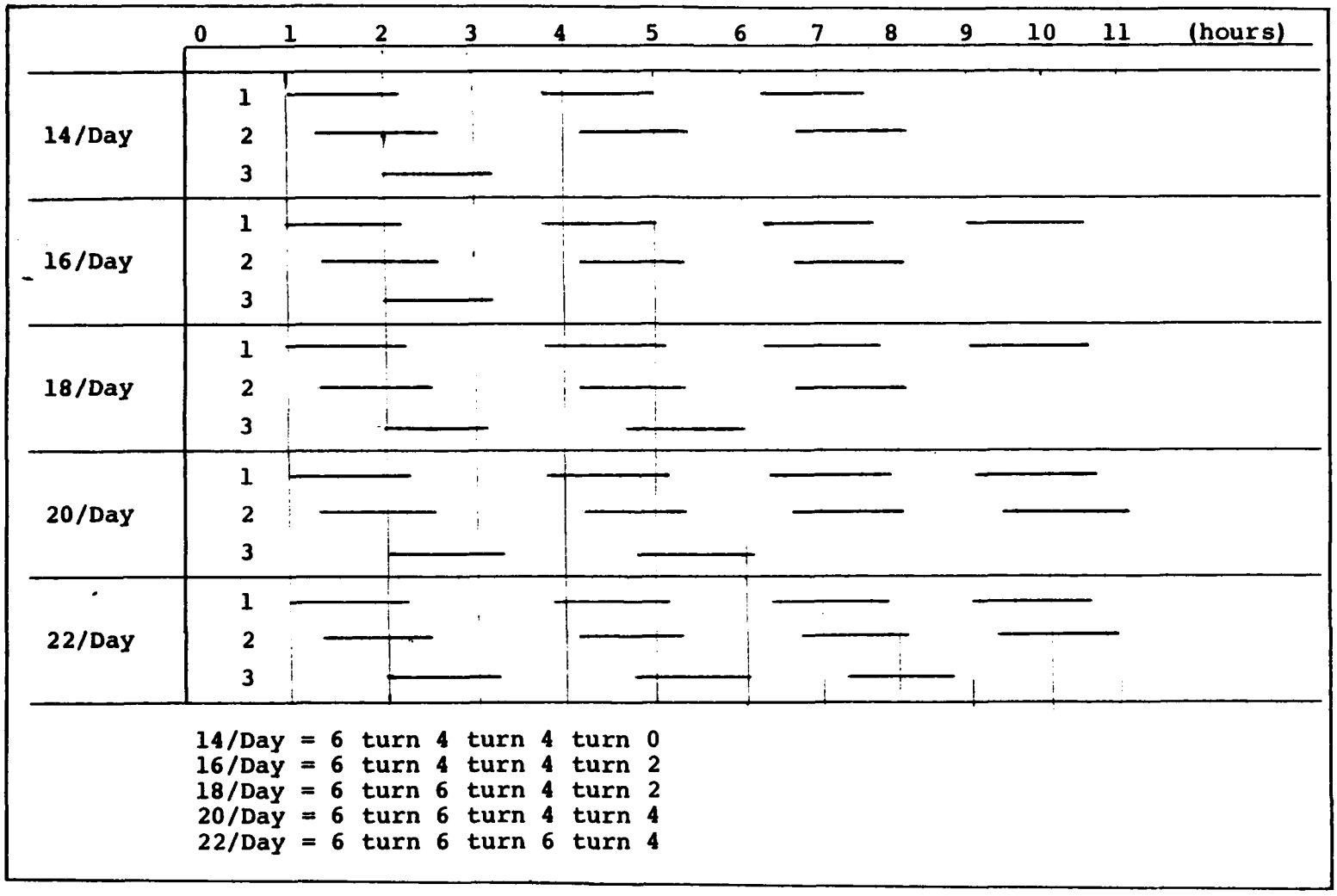

Fig. 3. Scheduled Sorties

due to maintenance, manpower, and spare parts constraints. The five scheduled sortie rates listed were chosen to model the flight operations. In practice, many turn combinations can be used depending upon availability of dedicated aircraft and maintenance capabilities. If more aircraft are dedicated to the schedule then the flying day can be shortened. In the 18/day schedule, if 4 two-ships are dedicated then a possible turn could be "8 turn 6 turn 4." Again, the programmed attrition can be seen. Only six out of the original eight need to be serviceable on the first turn and only four of the original eight need be on the second turn. Although the fly day is shortened, more dedicated aircraft are needed. At any wing, operations and maintenance must decide which turn options are best for them.

One extremely important point to be discussed in F-4E flight operations is that of different aircraft configurations. Some aircraft configurations are compatible only with certain missions. An example is an aircraft without any external stores can only fly an Air-to-Air Combat training mission and cannot perform an Air-to-Ground gunnery mission since it has no external stores. There are, however, several mutually compatible configurations that can be flown on all three missions. Configurations chosen in the schedules of Figure 3 are assumed to be mutually compatible for all missions.

If a model were to treat aircraft and pilots as resources, then each pilot and each aircraft would have to be accounted for on each simulation run. The simulation model in this thesis does not treat them as resources. It accounts only for the outcome of scheduled sorties being effective or not, and to which class of pilots they are attributed. It would still be encumbent upon squadron supervisors to schedule individual pilots to fly based upon their requirements against the actual sorties scheduled on a day-to-day basis. The model merely projects expected GCC sorties based upon established attrition rates.

Scheduled Pilot Operations

A time table for an individual pilot's scheduled operations is listed in Figure 4. Three hours before a flight the leader and wingman plan the mission. Two hours prior they conduct a one-hour briefing of the mission to be flown. After the briefing they report to their respective airplanes for preflight inspections, and then prepare to start engines thirty minutes before takeoff. After engine start and ground checks, the formation taxies to the arming area where maintenance personnel arm ordnance and perform a "last chance" inspection. The pilots fly their missions. The debriefing begins with maintenance to document the mission flown and any discrepancies noted

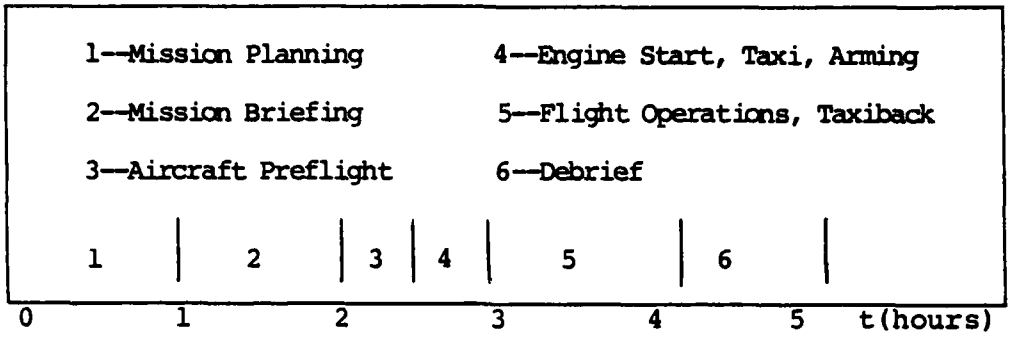

Fig. 4. Pilot Scheduled Operations

with the aircraft. It ends with the pilots' debriefing. As shown, a typical sortie of 1+20 requires more than five hours of time by a pilot.

Time Distributions

The time distributions for the model are listed on Table IV. The distributions for ground operations are not exact as they do not allow unexpected delays. Since the model will use ground attrition at engine start, the listed distributions will allow normal ground operations. The three type GCC missions available to fly are Air-to-Ground, Pave-Spike/Maverick, and Air-to-Air Combat. Pave-Spike/Maverick missions are a type of Air-to-Ground mission for specialized aircrews qualified in laser guided/infrared homing weapons. Collateral missions that occur will utilize the time distribution for the scheduled mission. These time distributions and percentages are used by TAC and are listed in Table IV (Ref 9).

TABLE IV

TIME DISTRIBUTIONS

Operation	Distribution (Minutes)	Percentage Scheduled
Ground: Start	Constant - 30	100
Taxi	N ~ (20,2)	100
Arming	N ~ (8,1)	100
Takeoff Sequencing	UN ~ (0-2)	100
Taxiback	Constant - 5	100
Air: Air-to-Ground	N ~ (66.6,13.2)	.571
Pave-Spike/Maverick	N ~ (65.2,4.8)	.347
Air-to-Air Combat	N ~ (106.8,10.2)	.082

Historical Attrition

The historical attrition figures for an F-4E wing are listed in Table V (Ref 12). As shown, these figures range from 10 percent to 19 percent of scheduled sorties and account for total ground attrition. The air-abort rate is 1 percent and holds constant from month to month.

System Attrition

Since a two-ship formation is comprised of two independent like aircraft, each has an equal and independent probability of ground aborting. As shown in Table VI, the four distinct possibilities associated with any

TABLE V

ANNUAL GROUND ATTRITION

Month	Maintenance	Weather	Higher Headquarters	Other	Total
Jan	3.0	13.0	1.0	2.0	19.0
Feb	3.0	9.0	1.0	2.0	15.0
Mar	3.0	9.0	1.0	2.0	15.0
Apr	3.0	5.0	1.0	1.0	10.0
May	3.0	7.0	1.0	1.0	12.0
Jun	3.0	6.0	1.0	1.0	11.0
Jul	3.0	8.0	1.0	1.0	13.0
Aug	3.0	8.0	1.0	1.0	13.0
Sep	3.0	6.0	1.0	1.0	11.0
Oct	3.0	8.0	0.5	0.5	12.0
Nov	3.0	9.0	1.0	2.0	15.0
Dec	3.0	11.0	1.0	2.0	17.0

TABLE VI

FLIGHT PROBABILITIES

$p(\#1 \text{ fly}) = p$; $P(\#1 \text{ abort}) = 1 - p = q$
$p(\#2 \text{ fly}) = p$; $P(\#2 \text{ abort}) = 1 - p = q$
$p(\#1 \text{ abort} \cap \#2 \text{ abort}) = P(\#1 \text{ abort})\ P(\#2 \text{ abort}) = q.q = q^2$
$p(\#1 \text{ fly} \cap \#2 \text{ abort}) = P(\#1 \text{ fly})\ P(\#2 \text{ abort}) = p.q$
$p(\#1 \text{ abort} \cap \#2 \text{ fly}) = P(\#1 \text{ abort})\ P(\#2 \text{ fly}) = q.p$
$p(\#1 \text{ fly} \cap \#2 \text{ fly}) = P(\#1 \text{ fly})\ P(\#2 \text{ fly}) = p.p = p^2$

formation of two is for neither sortie to fly, a single sortie to fly, or for both sorties to fly.

Mission Probabilities

A difference exists between classes of pilots in the probability of flying a GCC sortie once one member has ground aborted. A flight leader, by virtue of being experienced, is able to continue an Air-to-Ground or Pave-Spike/Maverick mission if his inexperienced wingman has aborted. If he were scheduled for an Air-to-Air Combat mission then he would have to fly a collateral sortie since an Air-to-Air Combat mission must be comprised of two sorties. The probability of an inexperienced pilot to continue the prebriefed mission if his leader ground aborts is not the same. TAC currently allows for a squadron commander to decide on an individual basis if an inexperienced pilot can continue or not after his leader aborts. The

probability of continuing with the GCC sortie (not Air-to-Air Combat) or flying a collateral mission is determined to be equal. If either member of a two-sortie formation has to air abort, then the other member will escort the air abort back and will be a sympathetic air abort.

Training Period Requirements

Using the GCC sortie requirements of Table I, a new table of total sortie requirements for a six-month training period (120 days) for pilots (experienced and inexperienced) is listed in Table VII. The totals reflect all sorties as being GCC.

TABLE VII

TOTAL SORTIE REQUIREMENTS

	GCC Sorties		
Pilots	A	B	C
Experienced	516	768	984
Inexperienced	612	888	1128
Total	1128	1656	2112

Structural Model

The first step in the synthesis of the experimental design is to develop the structural model. This involves choosing both the number of factors and the number of

levels of each factor that are deemed necessary. The two factors to be included are:

1. Scheduled sortie rate
2. Attrition rate

The levels associated with each factor were chosen to be fixed as this allowed easier programming changes from level to level. The number of levels was dictated by sortie rates as they are bounded, and are scheduled in increments of two. The lowest scheduled sortie rate an organization would want to plan for an extended period is 14/day since below this rate, the unit would normally not be able to fly at level A. The most an organization can sustain for an extended period due to maintenance and parts constraints is 22/day (Ref 9). These upper and lower bounds coupled with sortie increments of two, set the levels of sortie rates equal to 5. To keep the levels of both factors equal, the factor levels of each are:

Factor	Levels				
Scheduled Sortie Rate	14,	16,	18,	20,	22
Attrition Rate (%)	10,	12.5,	15,	17.5,	20

The structural model plays a key role in the programming of the model and the experimental design which will be presented in the following chapters.

Summary

This section has discussed the characteristics of F-4E flight operations and the structural design used in the model. The following chapter discusses how those operations were incorporated into the computer model of the system.

III Simulation Model

An F-4E squadron's operations were modeled into the Q-GERT network shown in Appendix A. The network routes sorties from their scheduled start until their end. Through the course of the network, a sortie collects levels of attributes which are used to describe the sortie. Three subroutines are used to collect the sortie descriptions. In Figure 5 the basic logic of the network is shown. For a particular schedule, a clock mechanism is initiated and it generates sorties until the scheduled time limit expires. At this point no future generation is accomplished, but those sorties already generated will flow through the network until completed. Next, the generated sorties are branched for the programmed attrition rate. If the sortie does not fly then it is counted as ground attrition and output in a sortie information file. If the sortie does fly it is branched for particular GCC missions. If the missions are not effective then they are counted as collateral missions and output into the sortie information file. If they are effective, then they are counted as GCC sorties and output into the sortie information file. After each run of the model, the user knows exactly what happened to each scheduled sortie. More detailed descriptions of

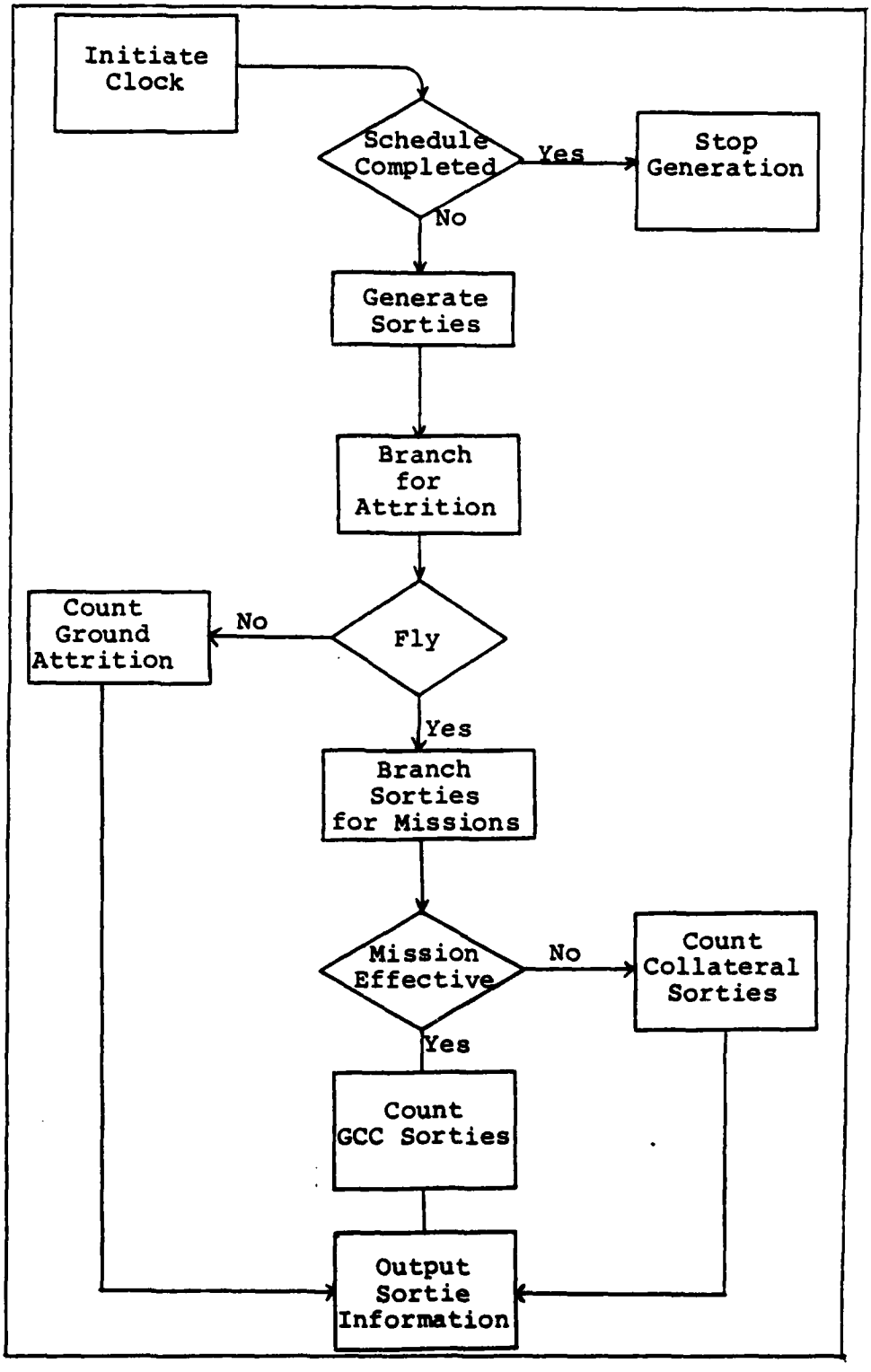

Fig. 5. Basic Network Logic

the Q-GERT network and the FORTRAN subroutines used are found in the following paragraphs.

Network

Sorties are generated initially by node 40 and subsequently by nodes 30 through 37. Nodes 30 through 37 act as the clock for the system and operate via nodal modification of node 1. Nodal modification allows for transactions to be sequenced in a predetermined manner. In the model it allows the sorties to flow in their scheduled sequence. By differing activity times between node 30 and node 37 the five different scheduled sorties rates (14, 16, 18, 20, 22) can be generated. The coding for the nodal modification is contained in Appendix B. At node 1, the transaction acquires an initial set of attributes. Attribute 1 corresponds to an experienced sortie while attribute 2 corresponds to an inexperienced sortie. Attributes 3 through 7 deal with types of sorties. Appendix A also contains the list of attributes assigned to sortie types. It is important to understand that each transaction departing node 1 carries with it both an experienced and inexperienced sortie. At node 2 the sorties are branched according to the probabilities of flight. The levels of the factor attrition are established here. The coding for the attrition is contained in Appendix B. The branch to node 15 represents both the experienced and the inexperienced sortie

ground aborting. Node 16 represents the experienced sortie ground aborting and the inexperienced sortie flying; while node 17 represents the inexperienced sortie ground aborting and the experienced sortie flying. Node 3 represents both sorties flying. When both sorties ground abort the transaction flows to node 60 where it is tracked.

At node 16 the attributes are changed to reflect losing the experienced sortie. The inexperienced sortie taxies to the arming area (node 51), is given a last chance inspection, armed, and then awaits takeoff at node 53. The lost experienced sortie flows to node 60 to be tracked. When the inexperienced sortie is lost, it is tracked from node 17 to node 60 while the experienced sortie flows to the takeoff sequence at node 58. When both sorties are to fly, they taxi from node 3 to arming and last chance inspection at node 5. From here they await takeoff at node 6.

When the experienced sortie ground aborts, the inexperienced sortie has three possible types of sorties it can be launched for. These are an Air-to-Ground mission (node 53 to node 80), Pave-Spike/Maverick mission (node 53 to node 81), and a collateral mission to node 43. The three nodes 80, 81, and 43 have a probability of aborting of 1 percent each. Air aborts for these nodes flow through node 88, where they are branched to nodes 89 and 60. The nodes 80, 81, and 43 have a 99 percent chance of flying their respective missions and proceed to nodes 7, 7, and 8.

When the inexperienced sortie ground aborts it has the same three possible types of sorties to fly also but has differing probabilities of flying them. The air abort rates stay the same as before and flow from node 69 to nodes 60 and 73. The nodes 82, 83, and 45 have a 99 percent chance of flying their respective missions and flow to nodes 7, 7, and 8.

When both sorties fly the transaction flows to node 6 where three types of missions await. Both sorties are branched probabilistically to node 84, 85, or 68. The air aborts are branched to nodes 74 and then flow to both node 60 and node 8. Sorties that do not air abort fly their respective missions to one of the three nodes of 65, 66, or 67.

Node 7 collects all GCC sorties while node 8 collects collateral sorties. They in turn flow to nodes 9 and 12 which branch according to attributes 1 and 2. Nodes 10, 11, 12, and 13 assign attributes and flow to node 60 which acts as a sink for the system.

Subroutine UI

This subroutine serves as an initialization step prior to each run of the network. Those variables that need to be initialized to zero to count daily functions are done so. A copy of this subroutine and the other subroutines

are contained in Appendix C. Variable names and descriptions are also contained in Appendix C.

Function UF

This subroutine serves the purpose of counting both daily figures and totals for the training period. All nodes flowing to node 60 call this user function. Air aborts are counted on lines 430 to 580. Ground aborts are counted on lines 620 to 760. The hours and sorties flown are counted on lines 790 to 1190.

Subroutine UO

This subroutine allows the user to obtain information from each subsequent run of the program. It is also used in the validation process which will be addressed later. A sample of this user output is contained in Appendix C.

This chapter incorporated the conceptual, parametric, and structural models of Chapter II to form the functional or computer model. It is through this model that data is collected. The third step in experimental design, the experimental model, provides for the analysis of that data and it is presented in the next chapter.

IV Data Collection

Measure of Merit

In this thesis, a scheduled sortie rate and a planned attrition rate were put through the system in each simulation run. Given the levels of both factors, this made a total of twenty-five different combinations of runs. The measure of merit is the number of GCC sorties that were accomplished on each run.

Sample Size Determination

The required number of replications was determined by analyzing fifty simulation runs with both factors set at level one. The results of these runs gave the following statistics:

Total Experienced GCC Sorties	Sample Mean	Sample Variance
296	5.92	.8769

Total Inexperienced Sorties	Sample Mean	Sample Variance
294	5.88	.9241

The objective of the analysis was to be at least 95 percent confident the sample mean would be within .25 of the true mean. Determination of the sample size required to achieve this was made using the formula (Ref 4:189):

$$n = \frac{t^2 s^2}{d^2}$$

where

t = tabulated t value for the desired confidence level and the degrees of freedom of the initial sample,

d = the half width of the desired confidence interval,

s^2 = the estimate of the variance obtained in the sample or pilot run, and

n = sample size required.

The results of the initial sample were:

$$n = \frac{(t_{49}^{.025})}{d^2} s^2 = \frac{(2.013)^2 (.9241)}{.25^2} = 59.9 \simeq 60$$

Based on this, it was determined that each combination of the two factors would be run 60 times.

Experimental Model

The experimental design used in this thesis followed a three-step process. First, the structural model determined the factors and their levels. Next, the functional model determined what and how much data could be collected. The last step in the process was the choice of an experimental model. The choice of the experimental model should allow both a solution of the original problem to be qualified and provide valid inferences to be drawn about the system.

To provide a solution to the problem of revising the schedule, a determination of a particular sortie rate must be made in order to achieve the predetermined GCC level. To determine a sortie rate out of the five levels there must be significant differences between them. Also, inferences must be made about attrition when it is forecasted to be between any two of the five established levels of attrition. To do these, the experimental model chosen was the analysis of variance approach to regression analysis. This approach allows simple linear regression equations to be formulated for each class of pilots. Each class of pilots has five regression lines corresponding to the five sortie rates. A table of the planned regression lines is listed in Table VIII. The model used is:

$$Y_i = \beta_o + \beta_i X_i + \varepsilon_i$$

where:

β_o and β_i are parameters;
X_i are the constant levels of attrition
ε_i are independent and $\sim N\ (o, \sigma^2)$, and
Y_i are observed values of GCC sorties.

For a given attrition rate, each of these equations provides an estimate of the number of GCC sorties that would be flown. The regression lines will be used to determine the revised sortie rate by comparing the estimates at a

TABLE VIII

REGRESSION LINES TO BE ANALYZED IN THE EXPERIMENT

Sortie Rate	Constant	Variable
14/Day	Attrition (all levels)	Experienced GCC Sorties
16/Day	Attrition (all levels)	Experienced GCC Sorties
18/Day	Attrition (all levels)	Experienced GCC Sorties
20/Day	Attrition (all levels)	Experienced GCC Sorties
22/Day	Attrition (all levels)	Experienced GCC Sorties
14/Day	Attrition (all levels)	Inexperienced GCC Sorties
16/Day	Attrition (all levels)	Inexperienced GCC Sorties
18/Day	Attrition (all levels)	Inexperienced GCC Sorties
20/Day	Attrition (all levels)	Inexperienced GCC Sorties
22/Day	Attrition (all levels)	Inexperienced GCC Sorties

particular attrition level with the remaining daily requirements. The regression line whose estimate first satisfies the remaining requirements is chosen as the revised sortie rate. This method allows the least number of scheduled sorties to achieve the desired GCC level. This method of determination will be described in further detail in Chapter VI. To determine that the regression lines within each class of pilots are different, the technique of comparing two regression lines will be used.

After the determination of the measure of merit, the sample size, and the experimental model was made, the experiment was run. The analytic methods and results of the experiment are presented in the next chapter.

V Data Analysis

Data analysis was conducted in five phases:

1. Computation of regression lines.
2. Checking regression lines for linearity.
3. Comparing regression lines for differences.
4. Checking normality assumptions.
5. Checking variance constancy.

The first phase utilized SPSS for the computation of the regression lines. This output is listed in Appendix D. The second phase required some manual computations of phase one's output to check for linearity. These computations are contained in Appendix E. The third phase involved comparing adjacent sortie regression lines to determine if differences existed between them and these comparisons are contained in Appendix F. Phase four checked for the normality assumptions and the computations are in Appendix G. Phase five checked for the constant variance assumption of linear regression and the computations are in Appendix H.

Regression Lines

Ten regression lines were calculated through the use of SPSS. Five are for experienced pilots and the other five are for inexperienced pilots. Each line corresponds

to a particular sortie rate (5:Levels) and was calculated from the data generated at the five levels of attrition. For each line there are 300 total data points of which 60 are from each level of attrition. The data is contained in Appendix I. The parameters for the regression lines are listed in Table IX. SPSS was used not only to calculate the regression coefficients but also to test the hypotheses:

$$H_0: \beta_0=0$$

$$H_1: \beta_1\neq0$$

Testing is done by comparing the F statistic with a table value and rejecting H_0 if the test is significant. As shown in Appendix D, each of the lines tested was highly significant at the $\alpha=.05$ level. This test is conducted to determine at a sortie rate if a linear relationship exists between the GCC sorties flown and the levels of attrition. From the tests it is concluded that those linear relationships cannot be rejected and therefore they are assumed to have linear relationships.

Regression Linearity

The method for determining whether a regression is linear or not is by testing for a "lack of fit" by the data. This is done by partitioning the mean square errors into a mean square pure error and a mean square lack of

TABLE IX

REGRESSION COEFFICIENTS

Pilot Type	Sortie Rate	β_0	β_1
Experienced	14	6.6966667	-.076666667
Experienced	16	8.1366667	-.11533333
Experienced	18	8.6433333	-.095333333
Experienced	20	10.066667	-.14533333
Experienced	22	11.723333	-.19533333
Inexperienced	14	6.7133333	-.082666667
Inexperienced	16	7.8266667	-.10466667
Inexperienced	18	9.0266667	-.12933333
Inexperienced	20	9.94	-.144
Inexperienced	22	10.916667	-.15533333

fit error. These two are tested by means of an F-statistic against a tabulated value. The test of hypotheses is:

H_0: the regression is linear

H_1: the regression is nonlinear

$$F^* = \frac{MS\ (LOF)}{MS\ (PURE)}$$

If $F^* > F$, then accept H_0, else reject.

From the tests contained in Appendix E it is determined that for all of the calculated regression lines the null hypothesis cannot be rejected and therefore they are assumed linear.

Regression Line Differences

This phase of the analysis was undertaken to evaluate whether the regression lines for a class of pilots were different from each other. The analysis is contained in Appendix F. Again, an F-statistic is used to test the hypotheses:

H_0: $\beta_{10} = \beta_{20}$ and $\beta_{11} = \beta_{21}$

H_1: either $\beta_{10} \neq \beta_{20}$ or $\beta_{11} \neq \beta_{21}$ or both

where by β_{ij}, i = number of regression line (1 or 2),

j = 0 for y axis intercept, and

j = 1 for slope of line.

Test for Normality

One of the underlying assumptions of the linear regression model is that the error terms are normally distributed. Two methods available to determine this are through graphic analysis of the residuals and by the Kolmogorov-Smirnov test. Studying error terms graphically is informal and is used to determine if substantial departures from normality are present. It should be pointed out that small departures from normality do not create any serious problems (Ref 14:107). To graphically test for normality, standardized residuals are plotted on normal probability paper and compared with the normal cumulative distribution. If approximately 68 percent of the residuals are between -1 and +1 then the residuals can be assumed normal. The Kolmogorov-Smirnov test is more formal and through the use of SPSS it can be employed quite easily.

Both of these tests were used in this thesis and are contained in Appendix G. From the graphical analysis it is evident that no substantial departures from normality are present in any of the models. The Kolmogorov-Smirnov tests on the other hand tend to show that the residuals are not normal. Part of the problem here is that no outliers were removed from the analysis because there was no evidence that they represented any errors. In the analysis the outliers acted to make the residuals nonnormal. Another part of the problem is that all of the residuals

generated resulted from discrete data. Since many of the observations had the same value the resulting residuals did also, and the nature of the Kolmogorov-Smirnov test accentuated it. For these reasons, it is determined that since no major departures from normality are present that the assumption of normality can still be used in the determinations of the regression coefficients.

Test for Constancy of Variance

Another underlying assumption of linear regression is that the error terms are normally distributed with constant variance. Initially, the scatter plot of residuals can be studied to determine whether the variance of the error terms is constant. The scatter plots from each of the SPSS linear regression runs were studied and there was an indication that the error terms tended to increase as the attrition rate was increased. This trapezoidal type of departure is shown in Figure 6. Although the indication of departure was present, the rate of departure did not appear to be large. A simple test for this type of heteroscedasticity is to fit separate regression functions to each half of the observations arranged by level of attrition. The mean square errors for each are then used as an F statistic and tested against a tabulated F value. The test of hypotheses is:

$$H_0: \sigma_1^2 = \sigma_2^2$$

$$H_1: \sigma_1^2 \neq \sigma_2^2$$

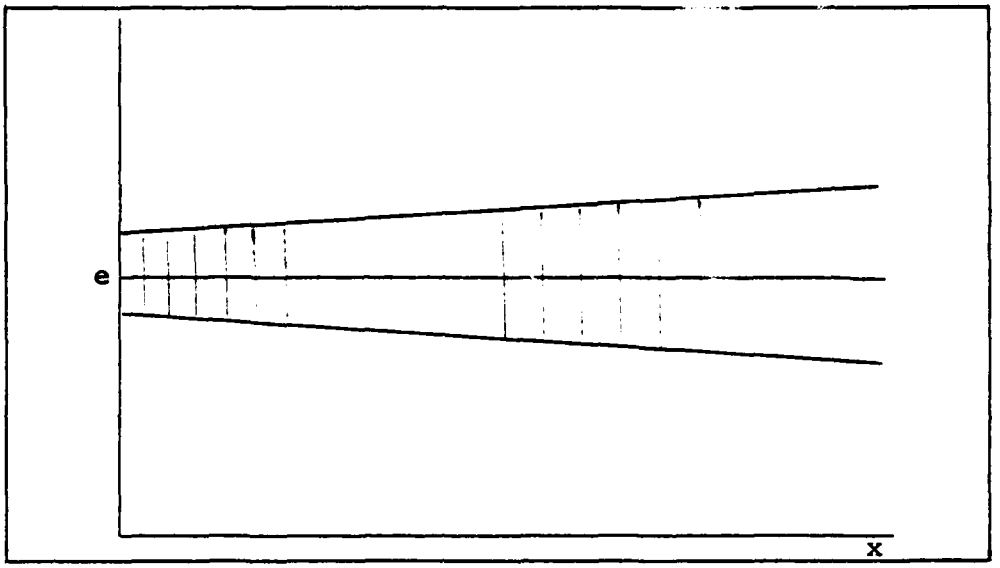

Fig. 6. Trapezoidal Departure

From the analysis conducted in Appendix H it is apparent that a majority of the regression lines have a departure from constant variance. There are two ways of handling this problem. One is that the model can be modified by either the method of weighted least squares or by a transformation to stabilize the variance. The other approach is when heteroscedasticity prevails but the other conditions of the model are met, the estimators β_0 and β_1 are still unbiased and consistent and can be used. They are, however, no longer minimum variance unbiased estimators.

Final Analysis

The final analysis of the regression models is to use the parameters of β_0 and β_1 as calculated. Through the individual sections of the analysis it was determined that

there were highly significant relationships between GCC sorties flown and levels of attrition. Also, the degree of linearity was again highly significant. Statistical differences between the individual lines were shown. The view that no major departures from normality occurred allows the interpretation that the parameters β_0 and β_1 can be used. This interpretation weighs heavily upon the degree of the linear relationships and the linearity.

This chapter has discussed the statistical analysis that was conducted on the regression lines. The next chapter will discuss how those lines were incorporated into the model to determine scheduled sortie rates.

VI Sortie Rate Model

The next step in the methodology of this thesis was to build an interactive computer model capable of determining a minimum scheduled sortie rate to allow a predetermined GCC level to be achieved. The third subobjective of this thesis was to incorporate the analyzed regression lines into the interactive model. To fulfill this last subobjective it was decided that a FORTRAN V computer program could be built to compare remaining GCC sortie requirements with the expected GCC sorties obtained from the individual regression lines. Since the model was to be used during the training period, it had to differentiate between the two classes of pilots. Given that experienced and inexperienced pilots are scheduled to fly together, and that GCC totals can differ, the model must be able to allow choosing the sortie rate that will allow both classes of pilots to reach the predetermined GCC level. It is possible that while a lower sortie rate could allow experienced pilots to achieve the GCC level, a higher rate would be needed for the inexperienced pilots to reach that same GCC level. In this case the higher of the two sortie rates must be chosen so that both classes can achieve at least the same GCC level since sorties are scheduled in two-ship

formations with one experienced and one inexperienced pilot. These guidelines and restrictions were programmed into the interactive model.

Model Description

The model, variable lists, and an example run are contained in Appendix J. The FORTRAN V program was designed for the user to input the following information in real numbers:

1. The number of flying days remaining in the training cycle
2. The number of experienced GCC sorties already accomplished
3. The number of inexperienced GCC sorties already accomplished
4. The GCC level desired (A=1., B=2., C=3.)
5. The expected or forecasted attrition rate

Once this information is input, the program calculates the number of experienced and inexperienced GCC sorties remaining for the desired GCC level. These sorties remaining are then divided by the number of flying days to obtain a daily rate of GCC sorties for experienced and inexperienced pilots. Next, the regression coefficients are used with the forecasted attrition rate to form two one-by-five arrays of sortie information. One array corresponds to the expected number of GCC sorties per day from experienced

pilots for the five sortie rate levels. The other array corresponds to the inexperienced pilots. The remainder of the program incorporates an algorithm to find the two minimum sortie rates to achieve the desired GCC level. This is done by first sequentially comparing the GCC sortie rates needed for experienced pilots against the experienced pilot array. The minimum sortie level to achieve the needed sortie rate is then output to the user. Next, the same process is done for the inexperienced pilots to determine their minimum sortie rate. The output sortie levels are real numbers and corresponds to:

1. 1. = 14 scheduled sorties per day
2. 2. = 16 scheduled sorties per day
3. 3. = 18 scheduled sorties per day
4. 4. = 20 scheduled sorties per day
5. 5. = 22 scheduled sorties per day
6. 0. = level not attainable

The user then compares the two sortie levels and chooses the higher of the two if they are unequal. The program also warns the user if a particular GCC level is not feasibly attainable by outputting a zero for the sortie rate. This corresponds to more than 22 scheduled sorties per day needed.

Example Description

The example contained in Appendix J was one of many that was run to determine optimum scheduled sortie rates to obtain a desired GCC level. The FORTRAN V program (SORTRAT) was compiled and the command to execute (LGO) was given. The input of sixty days remaining reflected approximately one-half of a training period remaining. The accomplished sorties for the pilots were arbitrary but not unreasonable. GCC level B (2 input) was chosen as the desired level. The forecasted attrition rate was chosen as 12 percent. The output information indicated that 14 scheduled sorties per day were needed for experienced pilots and 20 scheduled sorties per day were needed for inexperienced pilots. Comparing these two the higher rate of 20 scheduled sorties per day was chosen since this level will allow both classes of pilots to achieve at least the desired GCC level B.

This chapter has presented the rationale of how the model was made. It also described both the model and an example run. As mentioned before, many runs of program were executed and were examined. This examination was a part of the validation process that will be discussed in greater detail in the next chapter.

VII The Validation Process

This chapter presents the important process of validation. The validation process is the evaluation of a model to develop an acceptable level of confidence in its ability to accurately describe the true behavior of the system. This level of confidence also applies to those inferences drawn from the performance of the model. A three-step process suggested by Shannon for validation was used in this thesis:

1. Verification--insuring that the model behaves as the experimenter designed it to.

2. Validation--testing the behavior of the model and that of the real system for agreement.

3. Problem Analysis--the analysis and interpretation of the data generated by the computer model (Ref 4:210).

The first two steps of the process will be addressed in this chapter. The third step involving problem analysis was discussed in detail in the previous chapter.

Verification

Two categories of tests were performed to verify internal consistency. They are:

1. Statistical testing to determine if the simulation model handled attrition properly for five combinations of attrition and sortie rate.

2. Monitoring of computations and the movement of transactions to verify their performance for both models.

The tests accomplished in the verification process are discussed below.

Q-GERT Model Attrition. Since the main emphasis of this thesis was to draw inferences upon attrition rates and sortie levels, it was desirable to test each sortie rate at a particular attrition level to see if the average number of sorties flown was statistically the same as the expected number. This was to gain confidence in the Q-GERT probabilistic branching function. The hypotheses for these tests are:

$$H_0: \quad \mu \approx \mu_0$$

$$H_1: \quad \mu \neq \mu_0$$

The null hypothesis could not be rejected for any of the tests using an alpha of .01. The results of the tests are shown in Appendix K.

Q-GERT Model Performance. The trace option available with Q-GERT allows the user to follow all transactions in a time sequence to make sure they flow as they should.

Traces of the first run were made for each combination of the two levels for a total of 25. No discrepancies were noted during examination of any of the traces as all transactions flowed properly. The subroutine portion of the Q-GERT model was verified by monitoring the computations for all runs and no discrepancies were noted.

Sortie Rate Model Performance. The interactive model was verified by the monitoring of computations and is valid through its bounds of operations.

Validation

Validation of the simulation model centered primarily around acceptance of its results as indicative of the real system modeled. To do this the Turing test was used. This test requires a person or persons who are intimately familiar with the operations of the real system to be presented with one or more sets of input-output data from both the real system and the model. They are then asked to differentiate between the two sets of data, and if unable the model passes the test. One fighter pilot and one F-4 navigator were shown data of F-4 flights scheduled and flown. All data was totalled for 60 flying days. Neither of the two were able to distinguish differences between the data of the real world and that of the model. The acceptance of the model along with the accomplished verification established face validity for the

Q-GERT model. The intuitive acceptance of the interactive model as valid is based upon all of the analysis, verification, and validation done up to this point.

After the model had been validated and the results analyzed, the remaining steps in the thesis were to draw conclusions from the results and to recommend areas for further study. The following two chapters present those subjects.

VIII Conclusions and Recommendations

The research effort of this thesis followed the methodology as stated in Chapter I. The program of revising sortie rates was discussed first. Next, the objective was determined. The objective was to build an interactive model that could revise an F-4E squadron's scheduled sortie rate during a training period based upon a predetermined GCC level and accumulated pilot GCC sortie status. After the objective was determined the system was described. Next, the experiment was designed. This design included the structural, functional, and experimental models. The system modeled was then programmed and run. The data was collected and the regression lines were analyzed. The regression lines were then incorporated into the sortie rate model. The validation process was then conducted to evaluate the models' ability to accurately describe the true behavior of the system. Conclusions based upon this research are as follows:

1. F-4E Squadron operations can be modeled with Q-GERT.

2. Statistical linear relationships have been demonstrated between attrition rates and effective GCC sorties, given a scheduled sortie rate.

3. An interactive model to revise scheduled sortie rates to attain a predetermined GCC status is possible.

Based upon the above conclusions, the following recommendations are made:

1. Adaptations of the present model should be tailored to an existing F-4E unit and tested for applicability.

2. If applicable, the model should be adapted for use with other tactical aircraft.

3. If applicable, changes in TAFTRAMS could be made to track actual GCC sortie totals and use them as input for the interactive model.

IX Recommended Areas for Follow-on Study

This research effort, as in most, was unable to cover all of the aspects of the system studied. Presently, the usefulness of the model to an F-4E Wing is limited only to determining revised sortie rates. Some areas that are recommended for follow-on study concerning F-4E flight operations are discussed in the paragraphs below.

The first area involves the tracking of aircraft as resources. In this case daily operations would be highly dependent upon ground aborts, ground delays, air aborts, and maintenance turnaround time. Also, the treatment of configuration changes and compatibility could be studied. This could be extended to include determining an optimal mix of the types of GCC sorties (by configurations) to attain Major Air Command tasking.

The second area involves tracking individual pilots as resources and monitoring their GCC status on a daily basis. Studies concerning work load versus GCC status could be conducted.

The next area involves expanding the Q-GERT model to portray an actual F-4E squadron's operations. This model could include areas listed above. Time distributions portraying actual events could be included for the study of

flying hours or queueing effects at range areas. Lastly, studies could involve comparing the results of an expanded model with actual results of the F-4E squadron modeled to check for consistency of results.

It is not known at this time whether the areas listed above if included would greatly improve the validity of the present model. Secondly, there are undoubtedly many more areas that could be included for study and analysis involving flying and ground operations. Presently, however, the current model accomplishes the objectives for which it was constructed.

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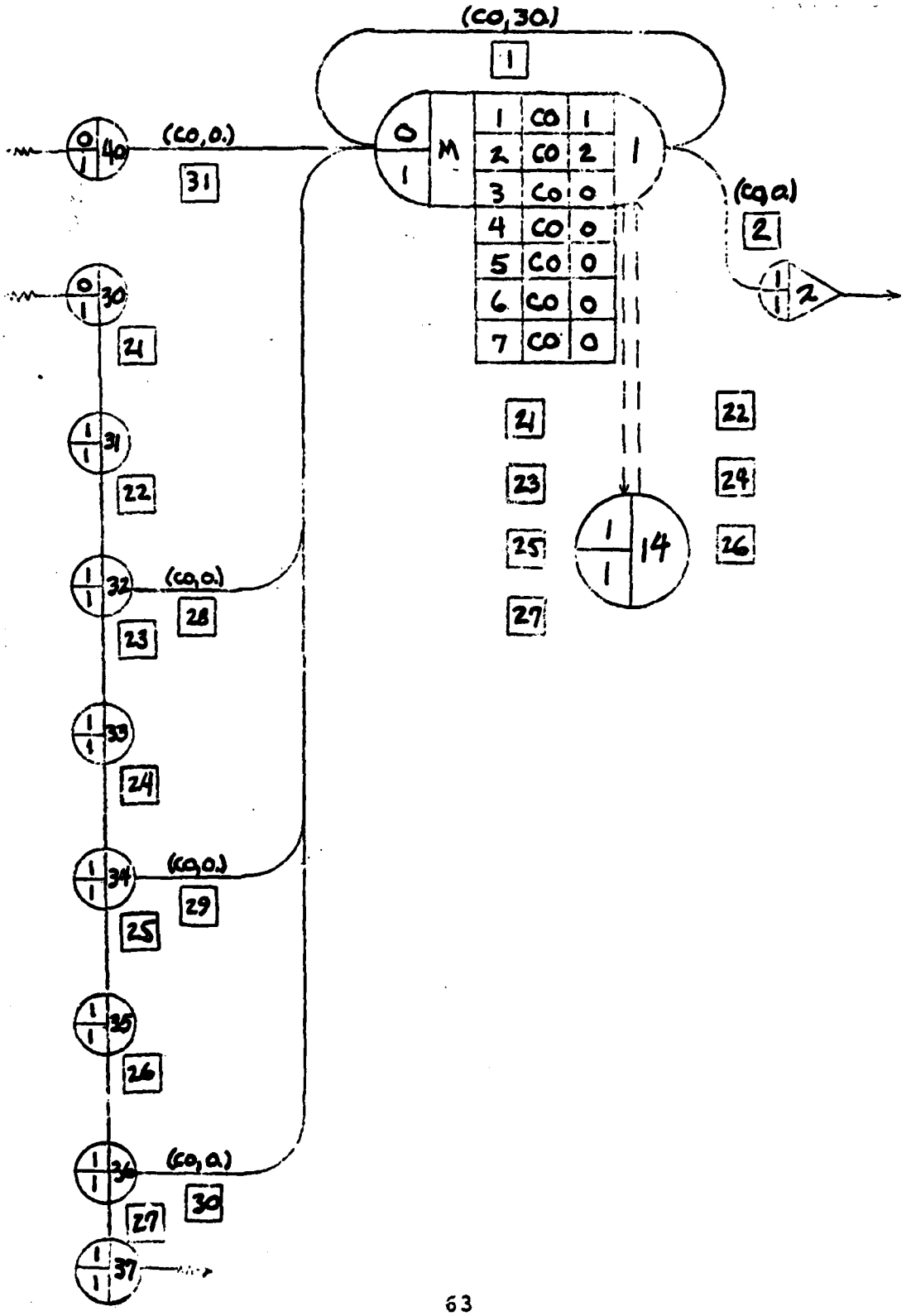
Appendix A

Q-GERT Network Diagram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M
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2 CO 2
3 CO 0
4 CO 0
5 CO 0
6 CO 0
7 CO 0
1
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40
31
(CO,0)
2
2
30
21
31
22
32
(CO,0)
28
23
33
24
34
(CO,0)
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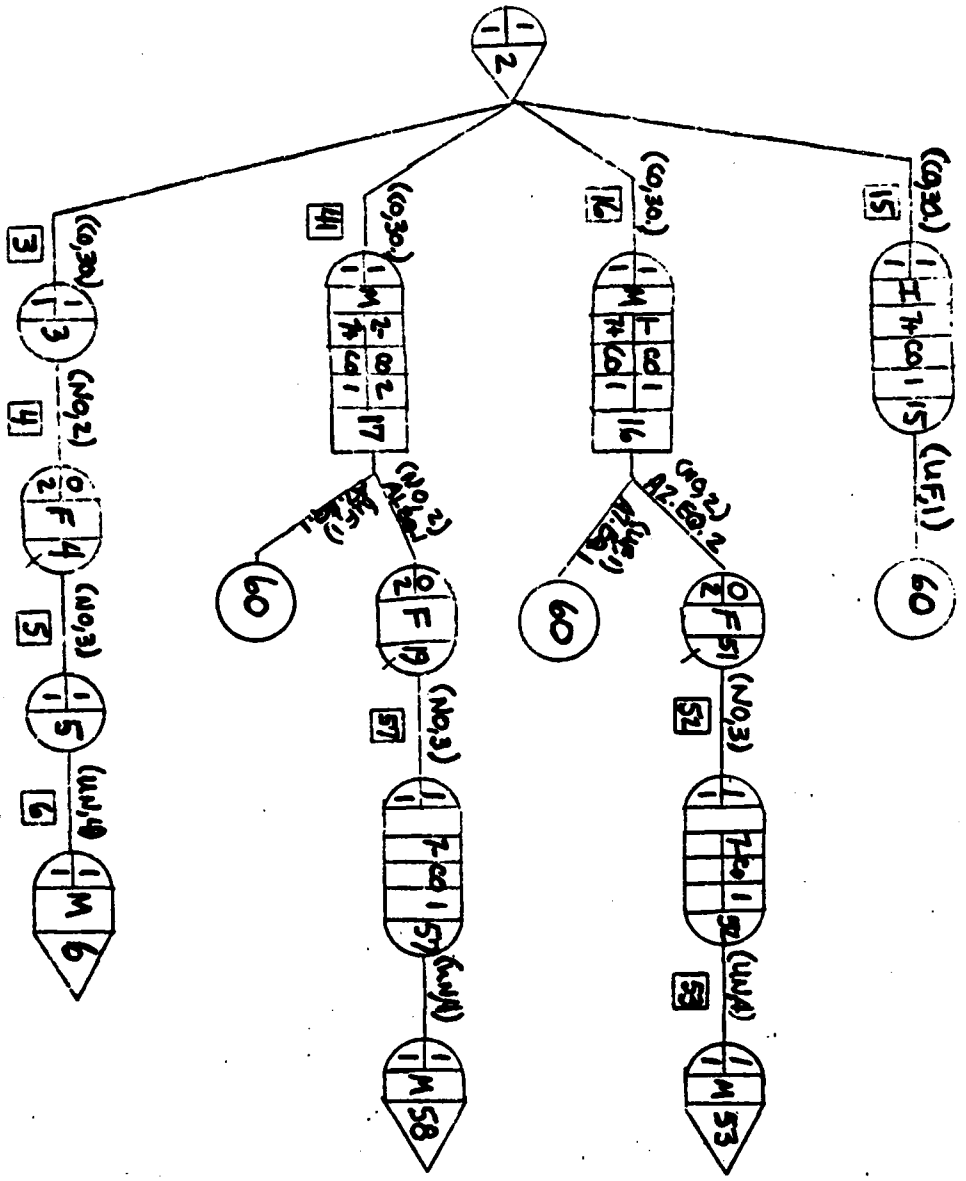
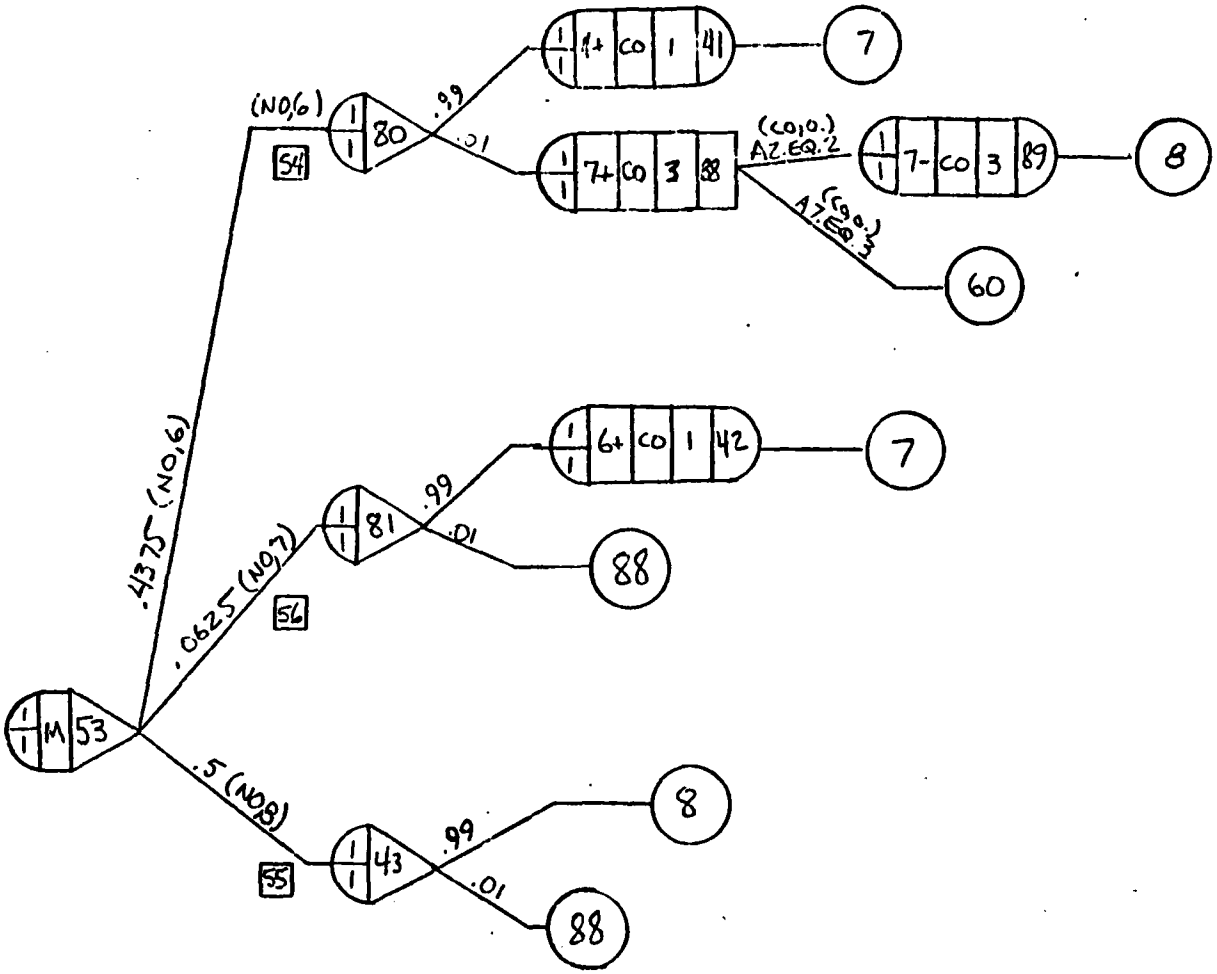
1

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.0625 (NO,7)
.5 (NO,8)
(NO,6)
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.99
.01
1+ CO 1 41
7
7+ CO 3 88
(CO,0.)
AZ.EQ.2
7- CO 3 89
8
(CO,0.)
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60
56
81
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.01
6+ CO 1 42
7
88
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.99
.01
8
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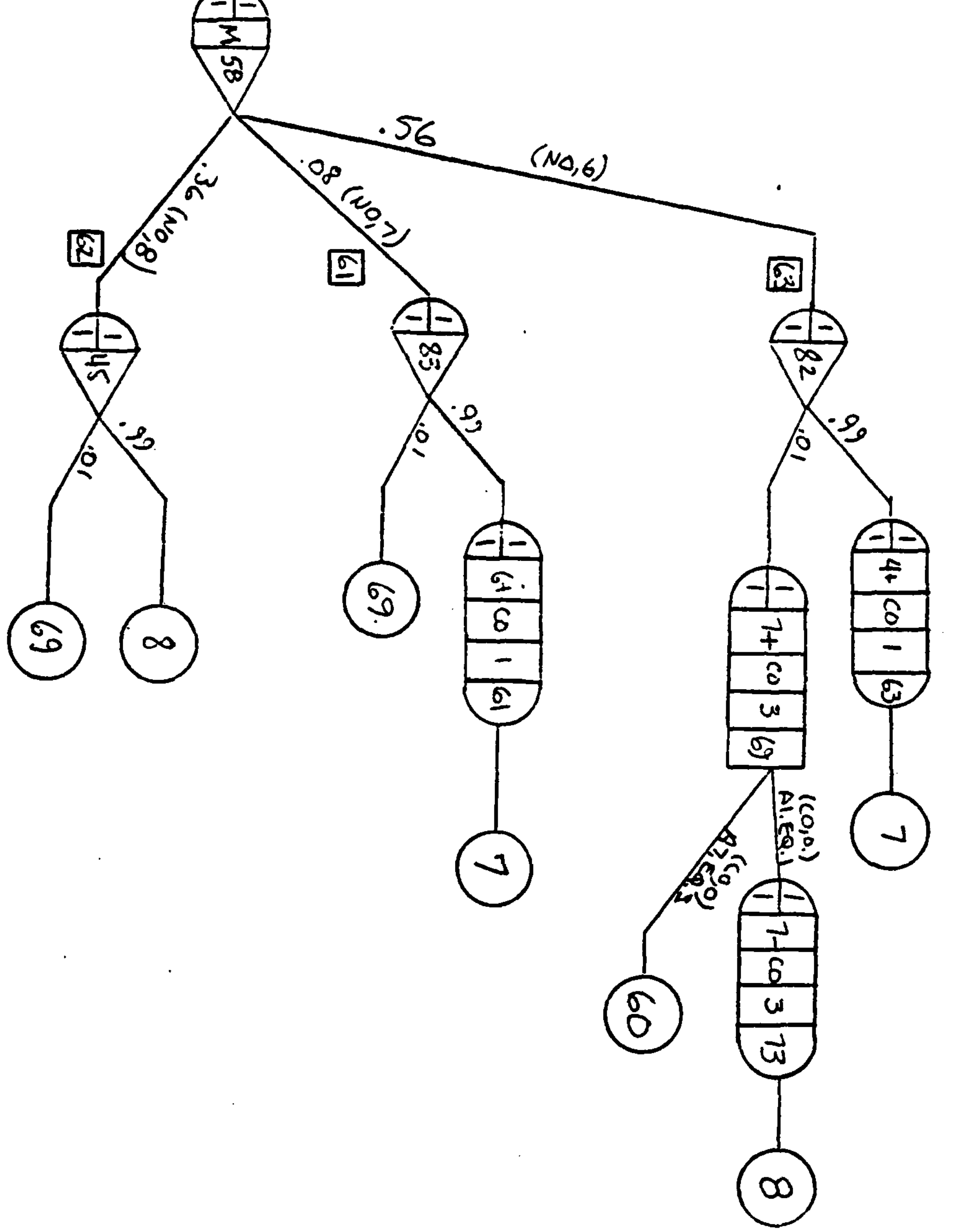

.56
(NO,6)
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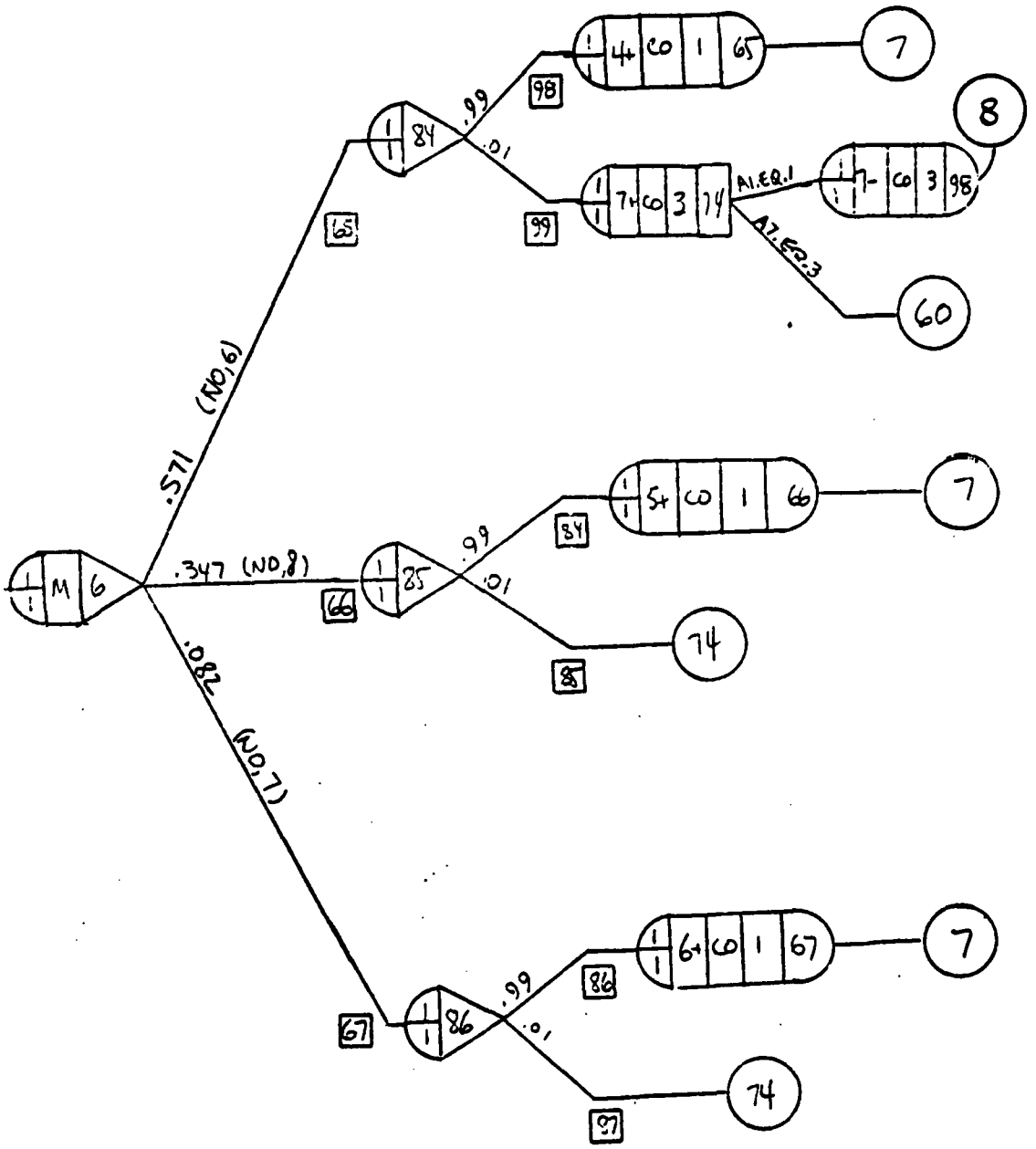
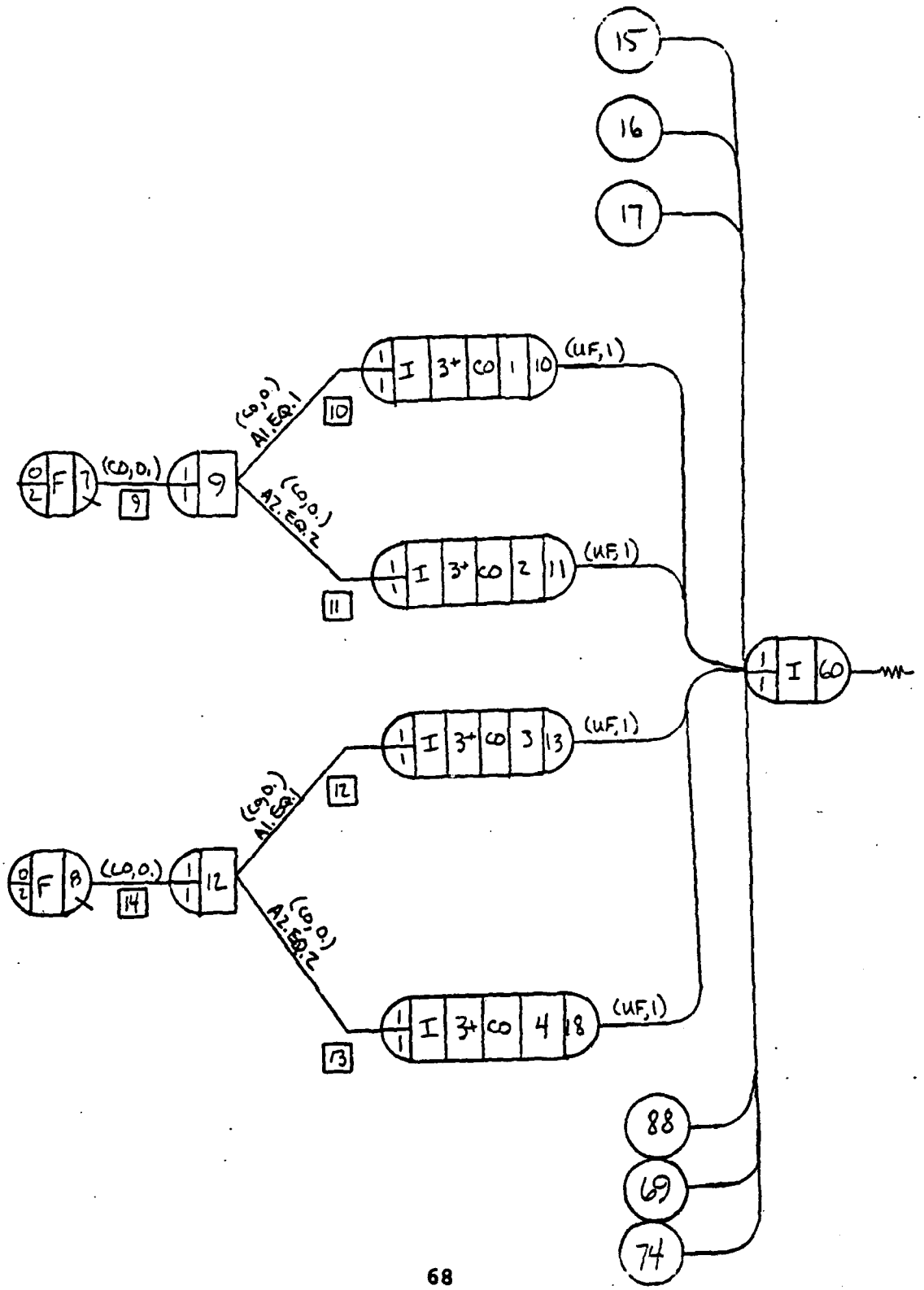
.01
.99


1 1 M 6
.571 (ND,6)
.347 (ND,8)
.082 (ND,7)
65
1 1 84
.99
.01
98
99
1 1 4 co 1 65
7
1 1 7+ co 3 74
A1.EQ.1
A1.EQ.3
8
1 1 7- co 3 98
60
66
1 1 85
.99
.01
84
85
1 1 5+ co 1 66
7
74
67
1 1 86
.99
.01
86
87
1 1 6+ co 1 67
7
74


15
16
17
I 3+ CO 1 10
(UF,1)
(C,0,)
A1.EQ.1
10
(CD,0,)
F 7
9
I 9
(C,0,)
A2.EQ.2
I 3+ CO 2 11
(UF,1)
11
I 60
I 3+ CO 3 13
(UF,1)
(C,0,)
A1.EQ.1
12
(C0,0,)
F 8
14
I 12
(C,0,)
A2.EQ.2
I 3+ CO 4 18
(UF,1)
13
88
69
74

Sortie Attributes

Attribute	Value	Sortie Type
1	0	None
1	1	Experienced
2	0	None
2	1	Inexperienced
3	0	Collateral
3	1	Experienced GCC
3	2	Inexperienced GCC
3	3	Experienced Collateral
3	4	Inexperienced Collateral
4	0	Non Air-to-Ground
4	1	Air-to-Ground
5	0	Non Air-to-Air
5	1	Air-to-Air
6	0	Non Pave Spike/Mav
6	1	Pave Spike/Mav
7	0	Non Ground Abort
7	1	Ground Abort
7	3	Air Abort

Appendix B

Q-GERT Computer Model

The model listed below (Thes1A) is the one that was used to generate GCC data with both factors held at level one (14 sorties, 10 percent attrition). Sorties were increased by increments of two by adjusting the timing of the nodal modification procedures. The subsequent four programs reflect that incremental increase of the sortie rate from 16 to 22. The change of attrition levels was done by adjustment of the probabilities associated with activities departing node 2. The last four program excerpts reflect the increases of attrition from 12.5 percent to 20 percent.

```
100=     GEN,WOOD,THES1A,11,19,1981,8,(10)900,60,(14)8;
110=       SOU,40,0,1;
120=       ACT,40,1;
130=       ACT,40,14;
140=       REG,1,1,1;
150=       ACT,1,1,CO,30.;
160=VAS,1,1,CO,1,2,CO,2,3,CO,0,4,CO,0,5,CO,0,6,CO,0,7,CO,0;
170=       REG,14,1-1;
180=       SOU,30,,,1;
190=       REG,31,1,1;
200=       ACT,30,31,CO,61.,,21;
210=       MOD,21,1,14;
220=       ACT,31,32,CO,99.,,22;
230=       REG,32,1,1;
240=       MOD,22,14,1;
250=       ACT,32,1;
260=       ACT,32,33,CO,31.,,23;
270=       REG,33,1,1;
280=       MOD,23,1,14;
290=       ACT,33,34,CO,129.,,24;
300=       REG,34,1,1;
310=       MOD,24,14,1;
320=       ACT,34,1;
```

```
330=       ACT,34,35,CO,31.,25*
340=       MOD,25,1,14*
350=       REG,35,1,1*
360=       ACT,1,2*
370=       REG,2,1,1,P*
380=      ACT,2,15,CO,30.,15,1,.01*
  390=       STA,15,1,1,D,1,0.,2.*
400=VAS,15,7+,CO,1*
410=ACT,15,60,UF,1*
420=       ACT,2,16,CO,30.,16,1,.09*
430=       REG,16,1,1,A*
440=       VAS,16,1-,CO,1,7+,CO,1*
450=       ACT,16,51,NO,2,51,1,1,A2.EQ.2*
460=ACT,16,60,UF,1,76,1,2,A7.EQ.1*
470=       QUE,51/ARMING,0,2,D,F*
480=       ACT,51,52,NO,3,52,1*
490=       REG,52,1,1*
500=VAS,52,7-,CO,1*
510=       ACT,52,53,UN,4,53,1*
520=       REG,53,1,1,P,M*
530=ACT,53,80,NO,6,54,1,.4375*
540=REG,80,1,1,P*
550=ACT,80,41,CO,0.,90,1,.99*
560=REG,41,1,1,D*
570=VAS,41,4+,CO,1*
580=ACT,41,7*
590=ACT,80,88,CO,0.,91,1,.01*
600=REG,88,1,1,A*
610=VAS,88,7+,CO,3*
620=ACT,88,89,CO,0.,69,1,1,A2.EQ.2*
630=ACT,88,60,UF,1,78,1,2,A7.EQ.3*
640=REG,89,1,1*
650=VAS,89,7-,CO,3*
660=ACT,89,8*
670=ACT,53,81,NO,7,56,1,.0625*
680=REG,81,1,1,P*
690=ACT,81,42,CO,0.,92,1,.99*
700=REG,42,1,1,D*

710=VAS,42,6+,CO,1*
720=ACT,42,7*
730=ACT,81,88,CO,0.,93,1,.01*
740=ACT,53,43,NO,8,55,1,.5*
750=REG,43,1,1,P*
760=ACT,43,8,CO,0.,42,1,.99*
770=ACT,43,88,CO,0.,43,1,.01*
780=ACT,2,17,CO,30.,41,1,.09*
790=REG,17,1,1,A*
800=VAS,17,2-,CO,2,7+,CO,1*
810=ACT,17,19,NO,2,20,1,1,A1.EQ.1*
820=ACT,17,60,UF,1,77,1,2,A7.EQ.1*

830=QUE,19/ARMING,0,2,D,F*
840=ACT,19,57,NO,3,57,1*
850=REG,57,1,1*
860=VAS,57,7-,CO,1*
870=ACT,57,58,UN,4,58,1*
880=REG,58,1,1,P,M*
890=ACT,58,82,NO,6,63,1,.56*
900=REG,82,1,1,P
910=ACT,82,63,CO,0.,94,1,.99*
920=REG,63,1,1,D*
930=VAS,63,4+,CO,1*
940=ACT,63,7*
950=ACT,82,69,CO,0.,75,1,.01*
960=REG,69,1,1,A*
970=VAS,69,7+,CO,3*
980=ACT,69,73,CO,0.,79,1,1,A1.EQ.1*
990=ACT,69,60,UF,1,78,1,2,A7.EQ.3*
1000=REG,73,1,1*
1010=VAS,73,7-,CO,3*
1020=ACT,73,8*
1030=ACT,58,83,NO,7,61,1,.88*
1040=REG,83,1,1,P*
1050=ACT,83,61,CO,0.,96,1,.99*
1060=REG,61,1,1,D*
1070=VAS,61,6+,CO,1*
1080=ACT,61,7*
1090=ACT,83,69,CO,0.,97,1,.01*
1100=ACT,58,45,NO,8,62,1,.36*
1110=REG,45,1,1,P*
1120=ACT,45,8,CO,0.,44,1,.99*
1130=ACT,45,69,CO,0.,45,1,.01*
1140=ACT,2,3,CO,30.,3,1,.81*
1150=REG,3,1,1*
1160=ACT,3,4,NO,2,4,1*
1170=QUE,4/ARMING,0,2,D,F*
1180=ACT,4,5,NO,3,5,1*
1190=REG,5,1,1*
1200=ACT,5,6,UN,4,6,1*
1210=REG,6,1,1,P,M*
1220=ACT,6,84,NO,6,65,1,.571*
1230=REG,84,1,1,P*
1240=ACT,84,65,CO,0.,98,1,.99*
1250=REG,65,1,1,D*
1260=VAS,65,4+,CO,1*
1270=ACT,65,7*
1280=ACT,84,74,CO,0.,99,1,.01*
1290=REG,74,1,1,A*
1300=VAS,74,7+,CO,3*
1310=ACT,74,98,CO,0.,81,1,1,A1.EQ.1*
```

```
1320=ACT,74,60,UF,1,82,1,2,A7.EQ.3*
1330=REG,99,1,1*
1340=VAS,98,7-,DC,3*
1350=ACT,98,8*
1360=ACT,6,85,NO,8,86,1,.347*
1370=REG,85,1,1,P*
1380=ACT,85,66,CO,0.,84,1,.99*
1390=REG,66,1,1,D*
1400=VAS,66,5+,CO,1*
1410=ACT,66,7*
1420=ACT,85,74,CO,0.,85,1,.01*
1430=ACT,6,86,NO,7,67,1,.082*
..L,1440,2040
1450=REG,86,1,1,P*
1460=ACT,86,67,CO,0.,86,1,.99*
1470=REG,67,1,1,D*
1480=VAS,67,6+,CO,1*
1490=ACT,67,7*
1490=ACT,86,74,CO,0.,87,1,.01*
1500=        QUE,7/RNG-HOLD,0,2*
1510=        ACT,7,9,CO,0.,9,1*
1520=        REG,9,1,1,A*
1530=        ACT,9,10,CO,0.,10,1,1,A1.EQ.1*
1540=        STA,10,1,1,D,I,0.,5.*
1550=        VAS,10,3+,CO,1*
1560=        ACT,9,11,CO,0.,11,1,2,A2.EQ.2*
1570=        STA,11,1,1,D,I,0.,5.*
1580=        VAS,11,3+,CO,2*
1590=        QUE,8/TR-WORK,0,2*
1600=        ACT,8,12,CO,0.,14,1*
1610=        REG,12,1,1,A*
1620=        ACT,12,13,CO,0.,12,1,1,A1.EQ.1*
1630=        STA,13,1,1,D,I,0.,5.*
1640=        VAS,13,3+,CO,3*
1650=        ACT,12,18,CO,0.,13,1,2,A2.EQ.2*
1660=        STA,18,1,1,D,I,0.,5.*
1670=        VAS,18,3+,CO,4*
1680=        ACT,10,60,UF,1*
1690=        ACT,11,60,UF,1*
1700=        ACT,13,60,UF,1*
1710=        ACT,18,60,UF,1*
1720=        STA,60,1,1,D,I,30.,10.*
1730=PAR,1,62.8,31.8,97.8,15.*
1740=        PAR,2,20.,14.,24.,2.*
1750=        PAR,3,8.,6.,11.,1.*
1760=        PAR,4,,0.,2.*
1770=PAR,6,61.6,36.,102.,13.2*
1780=PAR,7,59.2,36.,102.,4.8*
1790=PAR,8,101.8,60.,126.,10.2*
1800=        FIN*
1810=*EOR
```

```
100=      GEN,,QGD,THES2A,11,19,1981,8,(10)900,,0,(14)8*
110=        SOU,40,0,1*
120=        ACT,40,1*
130=        ACT,40,14*
140=        REG,1,1,1*
150=        ACT,1,1,CO,30.*
160=VAS,1,1,CO,1,2,CO,2,3,CO,0,4,CO,0,5,CO,0,6,CO,0,7,CO,0*
170=        REG,14,1,1*
180=        SOU,30,0,1*
190=        REG,31,1,1*
200=        ACT,30,31,CO,61.,21*
210=        MOD,21,1,14*
220=        ACT,31,32,CO,99.,22*
230=        REG,32,1,1*
240=        MOD,22,14,1*
250=        ACT,32,1*
260=        ACT,32,33,CO,31.,23*
270=        REG,33,1,1*
280=        MOD,23,1,14*
290=        ACT,33,34,CO,129.,24*
300=        REG,34,1,1*
310=        MOD,24,14,1*
320=        ACT,34,1*
330=        ACT,34,35,CO,31.,25*
340=        MOD,25,1,14*
350=        REG,35,1,1*
360=ACT,35,36,CO,189.,26*
370=REG,36,1,1*
380=MOD,26,14,1*
390=ACT,36,1*
400=ACT,36,37,CO,1.,27*
410=REG,37,1,1*
420=MOD,27,1,14*
430=        ACT,1,2*
440=        REG,2,1,1,P*
```

```
100=      GEN,WOOD,THES3A,11,19,1981,8,(12)900,60,(14)8*
 110=        SOU,40,0,1*
 120=        ACT,40,1*
 130=        ACT,40,14*
 140=        REG,1,1,1*
 150=        ACT,1,1,CO,30.*
 160=VAS,1,1,CO,1,2,CO,2,3,CO,0,4,CO,0,5,CO,0,6,CO,0,7,CO,0*
 170=        REG,14,1,1*
 180=        SOU,30,0,1*
 190=        REG,31,1,1*
 200=        ACT,30,31,CO,61.,21*
 210=        MOD,21,1,14*
 220=        ACT,31,32,CO,99.,22*
 230=        REG,32,1,1*
 240=        MOD,22,14,1*
 250=        ACT,32,1*
  260=         ACT,32,33,CO,61.,23*
 270=        REG,33,1,1*
 280=        MOD,23,1,14*
 290=        ACT,33,34,CO,99.,24*
 300=        REG,34,1,1*
 310=        MOD,24,14,1*
 320=        ACT,34,1*
 330=        ACT,34,35,CO,31.,25*
 340=        MOD,25,1,14*
 350=        REG,35,1,1*
 360=ACT,35,36,CO,189.,26*
 370=REG,36,1,1*
 380=MOD,26,14,1*
 390=ACT,36,1*
 400=ACT,36,37,CO,1.,27*
 410=REG,37,1,1*
 420=MOD,27,1,14*
 430=        ACT,1,2*
 440=        REG,2,1,1,P*
```

```
100=      GEN,WOOD,THES4A,11,19,1981,8,(10)900,60,(14)8*
110=       SOU,40,0,1*
120=       ACT,40,1*
130=       ACT,40,14*
140=       REG,1,1,1*
150=       ACT,1,1,CO,30.*
160=VAS,1,1,CO,1,2,CO,2,3,CO,0,4,CO,0,5,CO,0,6,CO,0,7,CO,0*
170=       REG,14,1,1*
180=       SOU,30,0,1*
190=       REG,31,1,1*
200=       ACT,30,31,CO,61.,21*
210=       MOD,21,1,14*
220=       ACT,31,32,CO,99.,22*
230=       REG,32,1,1*
240=       MOD,22,14,1*
250=       ACT,32,1*
260=       ACT,32,33,CO,61.,23*
270=       REG,33,1,1*
280=       MOD,23,1,14*
290=       ACT,33,34,CO,99.,24*
300=       REG,34,1,1*
310=       MOD,24,14,1*
320=       ACT,34,1*
330=       ACT,34,35,CO,31.,25*
340=       MOD,25,1,14*
350=       REG,35,1,1*
360=ACT,35,36,CO,189.,26*
370=REG,36,1,1*
380=MOD,26,14,1*
390=ACT,36,1*
400=ACT,36,37,CO,31.,27*
410=REG,37,1,1*
420=MOD,27,1,14*
430=       ACT,1,2*
440=       REG,2,1,1,P*
```

```
.30=      GEN,WOOD,THESSA,11,19,1981,8,(10)900,60,(14)8*
110=        SOU,43,0,1*
120=        ACT,40,1*
130=        ACT,40,14*
140=        REG,1,1,1*
150=        ACT,1,1,CO,30.*
160=VAS,1,1,CO,1,2,CO,2,3,CO,0,4,CO,0,5,CO,0,6,CO,0,7,CO,0*
170=        REG,14,1,1*
180=        SOU,30,0,1*
190=        REG,31,1,1*
  200=        ACT,30,31,CO,61.,21*
210=        MOD,21,1,14*
220=        ACT,31,32,CO,99.,22*
230=        REG,32,1,1*
240=        MOD,22,14,1*
250=        ACT,32,1*
260=        ACT,32,33,CO,61.,23*
270=        REG,33,1,1*
280=        MOD,23,1,14*
290=        ACT,33,34,CO,99.,24*
300=        REG,34,1,1*
310=        MOD,24,14,1*
320=        ACT,34,1*
330=        ACT,34,35,CO,61.,25*
340=        MOD,25,1,14*
350=        REG,35,1,1*
360=ACT,35,36,CO,99.,26*
370=REG,36,1,1*
380=MOD,26,14,1*
390=ACT,36,1*
400=ACT,36,37,CO,31.,27*
410=REG,37,1,1*
420=MOD,27,1,14*
430=        ACT,1,2*
440=        REG,2,1,1,P*
```

12.5 percent Attrition:

```
45@=      ACT,2,15,CO,3@.,15,1,.@15625+
..L,49@
49@=       ACT,2,16,CO,3@.,16,1,.1@9375+
..L,85@
85@=ACT,2,17,CO,3@.,41,1,.1@9375+
..L,121@
21@=ACT,2,3,CO,3@.,3,1,.765625+
```

15.0 percent Attrition:

```
45@=      ACT,2,15,CO,3@.,15,1,.@225+
..L,49@
49@=       ACT,2,16,CO,3@.,16,1,.1275+
..L,85@
85@=ACT,2,17,CO,3@.,41,1,.1275+
..L,121@
21@=ACT,2,3,CO,3@.,3,1,.7225+
```

17.5 percent Attrition:

```
45@=      ACT,2,15,CO,3@.,15,1,.@3@625+
..L,49@
49@=       ACT,2,16,CO,3@.,16,1,.144375+
..L,85@
95@=ACT,2,17,CO,3@.,41,1,.144375+
..L,121@
21@=ACT,2,3,CO,3@.,3,1,.68@625+
```

20.0 percent Attrition:

```
45@=      ACT,2,15,CO,3@.,15,1,.@4+
..L,49@
49@=       ACT,2,16,CO,3@.,16,1,.16+
..L,85@
85@=ACT,2,17,CO,3@.,41,1,.16+
..L,121@
21@=ACT,2,3,CO,3@.,3,1,.64+
```

Appendix C

Subroutines

The subroutines listed below were used to track and output the results of each run of the computer model. Included is a sample output from the 22/day sortie rate and 17.5 percent attrition level.

```
      SUBROUTINE UI
      COMMON/UCOM1/TOTFLTM,TOTEXGC,TOTINGC,TOTEXCO
     1,TOTINCO,TOTSRT
     1,HALFTM,EXGC,EXCO,DUMGC,DUMCO,SORTIES
     1,TOTAGEX,TOTAGIN,TOTAAEX,TOTAAIN,TOTPMEX,TOTPMIN
     1,TOTABEX,TOTABIN,ABEX,ABIN
     1,AGEX,AGIN,AAEX,AAIN
     1,PMEX,PMIN
     1,AABEX,AABIN,TOAABEX,TOAABIN
      TOTFLTM=TOTEXGC=TOTINGC=TOTEXCO=TOTINCO=TOTSRT=0.0
      TOTAGEX=TOTAGIN=TOTAAEX=TOTAAIN=TOTPMEX=TOTPMIN=0.0
      TOTABEX=TOTABIN=0.
      TOAABEX=TOAABIN=0.0
      RETURN
      END
      FUNCTION UF (IFN)
      COMMON/UCOM1/TOTFLTM,TOTEXGC,TOTINGC,TOTEXCO,TOTINCO,
     1TOTSRT
     1,HALFTM,EXGC,EXCO,DUMGC,DUMCO,SORTIES
     1,TOTAGEX,TOTAGIN,TOTAAEX,TOTAAIN,TOTPMEX,TOTPMIN
     1,TOTABEX,TOTABIN,ABEX,ABIN
     1,AGEX,AGIN,AAEX,AAIN,PMEX,PMIN
     1,AABEX,AABIN,TOAABEX,TOAABIN
      COMMON/QVAR/NDE,NFTBU(100),NREL(100),NRELP(100)
     1,NREL2(100)
     1,NRUN,NRUNS,NTC(100),PARAM(100,4),TBEG,TNOW
      DATA HALFTM,EXGC,EXCO,DUMGC,DUMCO/0.,0.,0.,0.,0./
      DATA AGEX,AGIN,AAEX,AAIN,PMEX,PMIN,ABEX,ABIN
     1/0.,0.,0.,0.,0.,0.,0.,0./
      DATA AABEX,AABIN/0.,0./
      DATA SORTIES /0./
```

```
      IF(CATRB(7).EQ.3..AND.CATRB(1).EQ.1..AND.CATRB(2).EQ.2.)
     1THEN
       AABEX=AABEX+1.
       AABIN=AABIN+1.
       TOAABEX=TOAABEX+1.
       TOAABIN=TOAABIN+1.
       UF=0.
       RETURN
       ELSEIF(CATRB(7).EQ.3..AND.CATRB(1).EQ.1.)THEN
       AABEX=AABEX+1.
       TOAABEX=TOAABEX+1.
       UF=0.
       RETURN
       ELSEIF(CATRB(7).EQ.3..AND.CATRB(2).EQ.2.)THEN
       AABIN=AABIN+1.
       TOAABIN=TOAABIN+1.
       UF=0.
       RETURN
       ELSE
       ENDIF
       UF=5.
       IF(CATRB(1).EQ.1..AND.CATRB(2).EQ.2..AND.CATRB(7).EQ.1.)
      1THEN
           TOTABEX=TOTABEX+1.
           ABEX=ABEX+1.
           TOTABIN=TOTABIN+1
           ABIN=ABIN+1.
        RETURN
        ELSEIF(CATRB(1).EQ.0..AND.CATRB(7).EQ.1.)THEN
           TOTABEX=TOTABEX+1.
           ABEX=ABEX+1.
        RETURN
        ELSEIF(CATRB(2).EQ.0..AND.CATRB(7).EQ.1.)THEN
           TOTABIN=TOTABIN+1.
           ABIN=ABIN+1.
        RETURN
        ELSE
        ENDIF
        TOTFLTM=TOTFLTM+(TNOW-TMARK(IDUM)+5.)/60.
        HALFTM=HALFTM+(TNOW-TMARK(IDUM)+5.)/60.
        IF(CATRB(3).EQ.1..AND.CATRB(4).EQ.1.)THEN
           TOTEXGC=TOTEXGC+1.
           EXGC=EXGC+1.
        TOTAGEX=TOTAGEX+1.
        AGEX=AGEX+1.
        ELSEIF(CATRB(3).EQ.1..AND.CATRB(5).EQ.1.)THEN
        TOTEXGC=TOTEXGC+1.
        EXGC=EXGC+1.
        TOTAAEX=TOTAAEX+1.
        AAEX=AAEX+1.
        ELSEIF(CATRB(3).EQ.1..AND.CATRB(6).EQ.1.)THEN
```

```
                TOTEXGC=TOTEXGC+1.
                EXGC=EXGC+1.
                TOTPMEX=TOTPMEX+1.
                PMEX=PMEX+1.
              ELSEIF(CATRB(3).EQ.2..AND.CATRB(4).EQ.1.)THEN
              TOTINGC=TOTINGC+1.
              DUMGC=DUMGC+1.
              TOTAGIN=TOTAGIN+1.
              AGIN=AGIN+1.
              ELSEIF(CATRB(3).EQ.2..AND.CATRB(5).EQ.1.)THEN
              TOTINGC=TOTINGC+1.
              DUMGC=DUMGC+1.
              TOTAAIN=TOTAAIN+1.
              AAIN=AAIN+1.
              ELSEIF(CATRB(3).EQ.2..AND.CATRB(6).EQ.1.)THEN
              TOTINGC=TOTINGC+1.
              DUMGC=DUMGC+1.
              TOTPMIN=TOTPMIN+1.
              PMIN=PMIN+1.
              ELSEIF(CATRB(3).EQ.3.)THEN
                 TOTEXCO=TOTEXCO+1.
                 EXCO=EXCO+1.
              ELSE
              TOTINCO=TOTINCO+1.
              DUMCO=DUMCO+1.
              ENDIF
              RETURN
              END
              SUBROUTINE UO
              COMMON/UCOM1/TOTFLTM,TOTEXGC,TOTINGC,TOTEXCO,TOTINCO,TOTSRT
             1,HALFTM,EXGC,EXCO,DUMGC,DUMCO,SORTIES
             1,TOTAGEX,TOTAGIN,TOTAAEX,TOTAAIN,TOTPMEX,TOTPMIN
            1,TOTABEX,TOTABIN,ABEX,ABIN
             1,AGEX,AGIN,AAEX,AAIN
             1,PMEX,PMIN,AABEX,AABIN,TOAABEX,TOAABIN
              COMMON/QVAR/NDE,NFTBU(100),NREL(100),NRELP(100)
             1,NREL2(100)
             1,NRUN,NRUNS,NTC(100),PARAM(100,4),TBEG,TNOW
              TOTSRT=TOTEXGC+TOTINGC+TOTEXCO+TOTINCO
              SORTIES=SORTIES+TOTEXGC+TOTINGC+TOTEXCO+TOTINCO
              WRITE(6,120)TOTAGEX
  120         FORMAT(10X,' EXPER AIR TO GROUND FOR DAY= ',2X,F6.2)
              WRITE(6,121)TOTAAEX
  121         FORMAT(10X,' EXPER AIR TO AIR FOR DAY= ',5X,F6.2)
              WRITE(6,122)TOTPMEX
  122         FORMAT(10X,' EXPER PS-MAV FOR DAY= ',9X,F6.2)
              WRITE(6,100)TOTEXGC
  100         FORMAT(10X,'TOTAL EXPERIENCED GCC FOR DAY =',1X,F6.2)
              WRITE(6,101)TOTEXCO
  101         FORMAT(10X,'TOTAL EXPERIENCED COL FOR DAY=',1X,F6.2)
              WRITE(6,123)TOTABEX
```

```
1430=123   FORMAT(10X,'TOTAL EXPERIENCED GAB FOR DAY=',1X,F6.2)
1440=      WRITE(6,125)TOTAGIN
1450=125   FORMAT(10X,' INEX AIR TO GROUND FOR DAY= ',3X,F6.2)
1460=      WRITE(6,126)TOTAAIN
1470=126   FORMAT(10X,' INEX AIR TO AIR FOR DAY= ',6X,F6.2)
1480=      WRITE(6,127)TOTPMIN
1490=127   FORMAT(10X,' INEX PS-MAV FOR DAY= ',10X,F6.2)
1500=      WRITE(6,102)TOTINGC
1510= 102  FORMAT(10X,'TOTAL INEXPERIENCED GCC FOR DAY= ',F6.2)
1520=      WRITE(6,103)TOTINCO
1530=103   FORMAT(10X,'TOTAL INEXPERIENCED COL FOR DAY= ',F6.2)
1540=      WRITE(6,124)TOTABIN
1550=124   FORMAT(10X,'TOTAL INEXPERIENCED GAB FOR DAY=',F6.2)
1560=      WRITE(6,104)TOTSRT
1570=104   FORMAT(14X,'TOTAL SORTIES FOR DAY= ',3X,F6.2)
1580=      WRITE(6,105)TOTFLTM
1590=105   FORMAT(14X,'TOTAL FLIGHT TIME FOR DAY= ',F6.2)
1600=      WRITE(6,129)AGEX
1610=129   FORMAT(10X,' EXPER AIR TO GROUND HALF = ',2X,F8.2)
1620=      WRITE(6,130)AAEX
1630=130   FORMAT(10X,' EXPER AIR TO AIR HALF= ',8X,F6.2)
1640=      WRITE(6,131)PMEX
1650=131   FORMAT(10X,' EXPER PS-MAV HALF= ',11X,F6.2)
1660=      WRITE(6,106)EXGC
1670=106   FORMAT(10X,' EXPERIENCED GCC FOR HALF= ',3X,F8.2)
1680=      WRITE(6,107)EXCO
1690=107   FORMAT(10X,'EXPERIENCED COL FOR HALF= ',4X,F8.2)
1700=      WRITE(6,154)ABEX
1710=154   FORMAT(10X,'EXPERIENCED GAB FOR HALF= ',4X,F8.2)
1720=      WRITE(6,140)AABEX
1730=140   FORMAT(10X,'EXPERIENCED AAB FOR HALF= ',4X,F8.2)
1740=      WRITE(6,151)AGIN
1750=151   FORMAT(10X,' INEX AIR TO GROUND HALF= ',6X,F6.2)
1760=      WRITE(6,152)AAIN
1770=152   FORMAT(10X,' INEX AIR TO AIR HALF= ',9X,F6.2)
1780=      WRITE(6,153)PMIN
1790=153   FORMAT(10X,' INEX PS-MAV HALF= ',13X,F6.2)
1800=      WRITE(6,108)DUMGC
1810= 108  FORMAT(10X,'INEXPERIENCED GCC-- HALF= ',4X,F8.2)
1820=      WRITE(6,109)DUMCO
1830= 109  FORMAT(10X,'INEXPERIENCED COL-- HALF= ',4X,F8.2)
1840=      WRITE(6,155)ABIN
1850=155   FORMAT(10X,'INEXPERIENCED GAB-- HALF= ',4X,F8.2)
1860=      WRITE(6,141)AABIN
870=141   FORMAT(10X,'INEXPERIENCED AAB-- HALF= ',4X,F8.2)
1880=      WRITE(6,110)HALFTM
1890=      WRITE(6,111)SORTIES
1900= 111  FORMAT(15X,'TOTAL SORTIES FOR HALF= ',F10.2)
1910= 110  FORMAT(15X,'FLIGHT TIME FOR HALF=  ',1X,F10.2)
1920=      RETURN
1930=      END
```

```
290=0*** NO ERRORS DETECTED IN INPUT DATA ***
5300=0*** EXECUTION WILL BE ATTEMPTED ***
5310=     ON RUN     1 SIMULATION ENDED DUE TO COMPLETION OF ALL ACTIV
IES AT TIME  641.7594
5320=          EXPER AIR TO GROUND FOR DAY=     7.00
5330=          EXPER AIR TO AIR FOR DAY=        2.00
5340=          EXPER PS-MAV FOR DAY=            1.00
5350=         TOTAL EXPERIENCED GCC FOR DAY =  10.00
5360=         TOTAL EXPERIENCED COL FOR DAY=   0.00
5370=         TOTAL EXPERIENCED GAB FOR DAY=   1.00
5380=          INEX AIR TO GROUND FOR DAY=     8.00
5390=          INEX AIR TO AIR FOR DAY=        2.00
5400=          INEX PS-MAV FOR DAY=            1.00
5410=         TOTAL INEXPERIENCED GCC FOR DAY=  11.00
5420=         TOTAL INEXPERIENCED COL FOR DAY=   0.00
5430=         TOTAL INEXPERIENCED GAB FOR DAY=  0.00
5440=             TOTAL SORTIES FOR DAY=     21.00
5450=             TOTAL FLIGHT TIME FOR DAY=  26.13
5460=          EXPER AIR TO GROUND HALF =      7.00
5470=          EXPER AIR TO AIR HALF=          2.00
5480=          EXPER PS-MAV HALF=             1.00
5490=          EXPERIENCED GCC FOR HALF=      10.00
5500=         EXPERIENCED COL FOR HALF=        0.00
5510=         EXPERIENCED GAB FOR HALF=        1.00
5520=         EXPERIENCED AAB FOR HALF=        0.00
5530=          INEX AIR TO GROUND HALF=        8.00
5540=          INEX AIR TO AIR HALF=           2.00
5550=          INEX PS-MAV HALF=               1.00
5560=         INEXPERIENCED GCC-- HALF=       11.00
5570=         INEXPERIENCED COL-- HALF=        0.00
5580=         INEXPERIENCED GAB-- HALF=        0.00
5590=         INEXPERIENCED AAB-- HALF=        0.00
5600=             FLIGHT TIME FOR HALF=       26.13
5610=             TOTAL SORTIES FOR HALF=     21.00
```

```
530=     ON RUN     2 SIMULATION ENDED DUE TO COMPLETION OF ALL ACTIV
IES AT TIME  635.1727
8540=          EXPER AIR TO GROUND FOR DAY=     7.00
8550=          EXPER AIR TO AIR FOR DAY=        1.00
8560=          EXPER PS-MAV FOR DAY=            2.00
9570=         TOTAL EXPERIENCED GCC FOR DAY =  10.00
8580=         TOTAL EXPERIENCED COL FOR DAY=   0.00
8590=         TOTAL EXPERIENCED GAB FOR DAY=   1.00
8600=          INEX AIR TO GROUND FOR DAY=     7.00
8610=          INEX AIR TO AIR FOR DAY=        1.00
8620=          INEX PS-MAV FOR DAY=            2.00
8630=         TOTAL INEXPERIENCED GCC FOR DAY=  10.00
8640=         TOTAL INEXPERIENCED COL FOR DAY=   1.00
8650=         TOTAL INEXPERIENCED GAB FOR DAY=  0.00
8660=            TOTAL SORTIES FOR DAY=     21.00
8670=            TOTAL FLIGHT TIME FOR DAY=  23.30
8680=          EXPER AIR TO GROUND HALF =      14.00
8690=          EXPER AIR TO AIR HALF=           3.00
8700=          EXPER PS-MAV HALF=              3.00
8710=          EXPERIENCED GCC FOR HALF=       20.00
8720=         EXPERIENCED COL FOR HALF=         0.00
8730=         EXPERIENCED GAB FOR HALF=         2.00
8740=         EXPERIENCED AAB FOR HALF=         0.00
8750=          INEX AIR TO GROUND HALF=        15.00
8760=          INEX AIR TO AIR HALF=            3.00
8770=          INEX PS-MAV HALF=                3.00
8780=         INEXPERIENCED GCC-- HALF=        21.00
8790=         INEXPERIENCED COL-- HALF=         1.00
8800=         INEXPERIENCED GAB-- HALF=         0.00
8810=         INEXPERIENCED AAB-- HALF=         0.00
8820=             FLIGHT TIME FOR HALF=        49.43
8830=              TOTAL SORTIES FOR HALF=      42.00
```

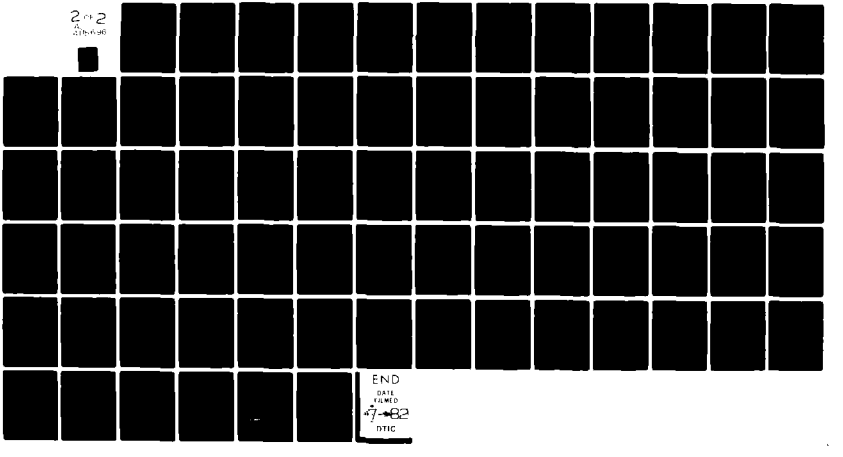
Subroutine UI Variables

Variable Name	Description
TOTFLTM	Flight Time
TOTEXGC	Experienced GCC Sorties
TOTINGC	Inexperienced GCC Sorties
TOTEXCO	Experienced Collateral Sorties
TOTINCO	Inexperienced Collateral Sorties
TOTSRT	Sorties
TOTAGEX	Experienced Air-to-Ground Sorties
TOTAGIN	Inexperienced Air-to-Ground Sorties
TOTAAEX	Experienced Air-to-Air Sorties
TOTAAIN	Inexperienced Air-to-Air Sorties
TOTPMEX	Experienced Pave-Spike/Mav Sorties
TOTPMIN	Inexperienced Pave-Spike/Mav Sorties
TOTABEX	Experienced Ground Abort
TOTABIN	Inexperienced Ground Abort
TOAABEX	Experienced Air Abort
TOAABIN	Inexperienced Air Abort

Function UF Variables

Variable Name	Description
HALFTM	Flight Time
EXGC	Experienced GCC Sorties
EXCO	Experienced Collateral Sorties
DUMGC	Inexperienced GCC Sorties
DUMCO	Inexperienced Collateral Sorties
SORTIES	Total Sorties
ABEX	Experienced Ground Aborts
ABIN	Inexperienced Ground Aborts
AGEX	Experienced Air-to-Ground Sorties
AGIN	Inexperienced Air-to-Ground Sorties
AAEX	Experienced Air-to-Air Sorties
AAIN	Inexperienced Air-to-Air Sorties
PMEX	Experienced Pave-Spike/Mav Sorties
PMIN	Inexperienced Pave-Spike/Mav Sorties
AABEX	Experienced Air Aborts
AABIN	Inexperienced Air Aborts

AD-A115 696 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOO--ETC F/G 5/9
A MODEL TO EVALUATE F-4E SQUADRON SCHEDULED SORTIE RATES AND PI--ETC(U)
MAR 82 J P WOOD
UNCLASSIFIED AFIT/GST/OS/82M-16 NL



Appendix D

Tests for Linear Relationships

Each of the regression lines calculated with SPSS used the same control cards except for the run name. An example of the 14 per day sortie rate is shown below:

```
100=1
 110=$
 120=
        02/02/82     11.00.33.     PAGE    1
 130=          VOGELBACK COMPUTING CENTER
 140=          NORTHWESTERN UNIVERSITY
 150=
 160=          S P S S - - STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES
 170=
 180=          VERSION 8.0 -- JUNE 18, 1979
 190=
 200=
 210=
 220=
 230=                    RUN NAME       RATE FOR 14
 240=                    VARIABLE LIST  X,Y
 250=                    INPUT FORMAT   FREEFIELD
 260=                    VAR LABELS     Y,SORTIES PER DAY/X,ATTRITION RATE
ATE
 270=                    REGRESSION     VARIABLES=Y,X
 280=                                   REGRESSION=Y(*,2,*,2) WITH X(2) RESID=0/
) RESID=0/
 290=                    STATISTICS     ALL
 300=                    OPTIONS        11,15,16
 310=                    READ INPUT DATA
 320=
 330=              00054400 CM NEEDED FOR REGRESSION
 340=
 350=
 360=
 370=              OPTION - 1
 380=              IGNORE MISSING VALUE INDICATORS
 390=              (NO MISSING VALUES DEFINED...OPTION 1 WAS FORCED)
 400=
```

The F statistics for each of the regression lines are listed below. Each F statistic is compared to $F(.95,1,298) \simeq 3.90$.

If $F^* > F_{.95,1,298}$ then reject H_0, else accept.

Experienced Pilot--14 per day sortie rate

$F^* = 21.03206$

Exprienced Pilot--16 per day sortie rate

$F^* = 43.40006$

Experienced Pilot--18 per day sortie rate

$F^* = 26.99251$

Experienced Pilot--20 per day sortie rate

$F^* = 48.47330$

Experienced Pilot--22 per day sortie rate

$F^* = 83.58737$

Inexperienced Pilot--14 per day sortie rate

$F^* = 25.02539$

Inexperienced Pilot--16 per day sortie rate

$F^* = 34.76406$

Inexperienced Pilot--18 per day sortie rate

$F^* = 42.77275$

Inexperienced Pilot--20 per day sortie rate

$F^* = 41.40013$

Inexperienced Pilot--22 per day sortie rate

$F^* = 53.68389$

Appendix E

Tests for Linearity

The statistics listed below were all obtained and tested in the following manner:

$$SSE(PURE) = Y_{ij}^2 - \frac{T_i^2}{n_i}$$

$$SSE(LOF) = SSE - SSE(PURE)$$

$$MS(PURE) = SSE(PURE)/295$$

$$MS(LOF) = SSE(LOF)/3$$

$$F^* = \frac{MS(LOF)}{MS(PURE)}$$

If $F^* < F_{.95,3,295} \simeq 2.6$ then accept H_0, else reject.

1. Experienced at 14/day

$$SSE(PURE) = 9564 - \frac{358^2 + 345^2 + 326^2 + 324^2 + 311^2}{60} = 311.3$$

$$MS(PURE) = 1.055 \quad , \quad SSE = 312.3050$$

$$SSE(LOF) = SSE - SEE(PURE) = 1.005$$

$$MS(LOF) = .335$$

$$F^* = \frac{.335}{1.055} = .3175$$

Therefore, accept H_0

2. Experienced at 16/day

$$SSE(PURE) = 12706 - \frac{425^2 + 397^2 + 397^2 + 368^2 + 353^2}{60} = 340.867$$

$$SSE(LOF) = SSE - SSE(PURE) = 1.6383, \quad SSE = 342.505$$

$$MS(LOF) = .5461 \quad , \quad MS(PURE) = 1.1555$$

$$F = \frac{.5461}{1.1555} = .4726$$

Therefore, accept H_0

3. Experienced at 18/day

$$SSE(PURE) = 16020 - \frac{463^2 + 453^2 + 423^2 + 414^2 + 411^2}{60} = 372.933$$

$$MS(PURE) = 1.2642$$

$$SSE = 376.265$$

$$SSE(LOF) = SSE - SSE(PURE) = 3.3317, \quad MS(LOF) = 1.1106$$

$$F^* = \frac{1.1106}{1.2642} = .8785$$

Therefore, accept H_0

4. Experienced at 20/day

$$SSE(PURE) = 19226 \frac{521^2 + 486^2 + 481^2 + 446^2 + 432^2}{60} = 483.7$$

MS(PURE) = 1.6397

SSE = 486.94

SSE(LOF) = SSE - SSE(PURE) = 3.24

MS(LOF) = 1.08

$$F^* = \frac{1.08}{1.6397} = .6587$$

Therefore, accept H_0

5. Experienced at 22/day

$$SSE(PURE) = 23850 - \frac{591^2 + 553^2 + 522^2 + 502^2}{60} \frac{+ 470^2}{} = 508.7$$

MS(PURE) = 1.7244

SSE = 510.105

SSE(LOF) = SSE - SSE(PURE) = 1.405

MS(LOF) = .4683

$$F^* = \frac{.4683}{1.7244} = .2716$$

Therefore, accept H_0

6. Inexperienced at 14/day

$$SSE(PURE) = 9318 - \frac{354^2 + 341^2 + 326^2 + 317^2 + 304^2}{60} = 305.033$$

$$MS(PURE) = 1.034$$

$$SSE = 305.16$$

$$SSE(LOF) = SSE - SSE(PURE) = .1267$$

$$MS(LOF) = .0422$$

$$F^* = \frac{.0422}{1.034} = .041$$

Therefore, accept H_0

7. Inexperienced at 16/day

$$SSE(PURE) = 12137 - \frac{413^2 + 388^2 + 370^2 + 355^2 + 351^2}{60} = 349.683$$

$$MS(PURE) = 1.1854$$

$$SSE = 352.155$$

$$SSE(LOF) = SSE - SSE(PURE) = 2.472$$

$$MS(LOF) = .824$$

$$F^* = \frac{.824}{1.1854} = .6951$$

Therefore, accept H_0

8. Inexperienced at 18/day

$$SSE(PURE) = 15566 - \frac{463^2 + 455^2 + 416^2 + 397^2 + 395^2}{60} = 431.267$$

$$MS(PURE) = 1.462$$

$$SSE = 437.02$$

$$SSE(LOF) = SSE - SSE(PURE) = 5.753$$

$$MS(LOF) = 1.9177$$

$$F^* = \frac{1.9177}{1.462} = 1.312$$

Therefore, accept H_0

9. Inexperienced at 20/day

$$SSE(PURE) = 18796 - \frac{515^2 + 483^2 + 465^2 + 445^2 + 426^2}{60} = 558.667$$

$$MS(PURE) = 1.894$$

$$SSE = 559.72$$

$$SSE(LOF) - SSE - SSE(PURE) = 1.053$$

$$MS(LOF) = .351$$

$$F^* = \frac{.351}{1.894} = .1853$$

Therefore, accept H_0

10. Inexperienced at 22/day

$$SSE(PURE) = 22712 - \frac{560^2 + 540^2 + 511^2 + 503^2 + 462^2}{60} = 499.1$$

$$MS(PURE) = 1.692$$

$$SSE = 502.265$$

$$SSE(LOF) = SSE - SSE(PURE) = 3.165$$

$$MS(LOF) = 1.055$$

$$F^* = \frac{1.055}{1.692} = .6235$$

Therefore, accept H_0

Appendix F

Tests for Line Differences

The statistics listed below were all obtained and tested in the following manner:

1. SSE Full = SSE(F) = $SSE_1 + SSE_2$

2. Combined (reduced) regression = SSE(R)

3. $F^* = \frac{SSE(R) - SSE(F)}{2} \div \frac{SSE(F)}{596}$

   If $F^* > F_{(1-\alpha)}$ reject H_0, else accept.

   $F_{(.95,2,596)} \simeq 3.0$

1. <u>Compare Inexperienced Regressions at 14 and 16 sorties/day</u>

   $SSE(F) = SSE_{14} + SSE_{16} = 305.16 + 352.155 = 657.315$

   SSE(R) = 750.26417

   $F^* = 42.139$

   Therefore, reject H_0 and conclude the two lines are different.

2. Inexperienced 16 and 18

$SSE(F) = SSE_{16} + SSE_{18} = 352.155 + 437.020 = 789.175$

$SSE(R) = 893.65083$

$F^* = 39.451$

Therefore, reject H_0 and conclude the two lines are different.

3. Inexperienced 18 and 20

$SSE(F) = SSE_{18} + SSE_{20} = 437.020 + 559.72 = 996.74$

$SSE(R) = 1069.250$

$F^* = 21.6787$

Therefore, reject H_0 and conclude the two lines are different.

4. Inexperienced 20 and 22

$SSE(F) = SSE_{20} + SSE_{22} = 559.72 + 502.265 = 1061.985$

$SSE(R) = 1159.8325$

$F^* = 27.4567$

Therefore, reject H_0 and conclude the two lines are different.

1. Experienced 14 and 16

$SSE(F) = SSE_{14} + SSE_{16} = 312.305 + 342.505 = 654.81$

$SSE(R) = 768.55333$

$F^* = 51.7639$

Therefore, reject H_0 and conclude the two lines are different.

2. Experienced 16 and 18

$SSE(F) = SSE_{16} + SSE_{18} = 342.505 + 376.265 = 718.77$

$SSE(R) = 817.12667$

$F^* = 40.7784$

Therefore, reject H_0 and conclude the two lines are different.

3. Experienced 18 and 20

$SSE(F) = SSE_{18} + SSE_{20} = 376.265 + 486.94 = 863.205$

$SSE(R) = 935.89917$

$F^* = 25.096$

Therefore, reject H_0 and conclude the two lines are different.

4. Experienced 20 and 22

$SSE(F) = SSE_{20} + SSE_{22} = 486.94 + 510.105 = 997.045$

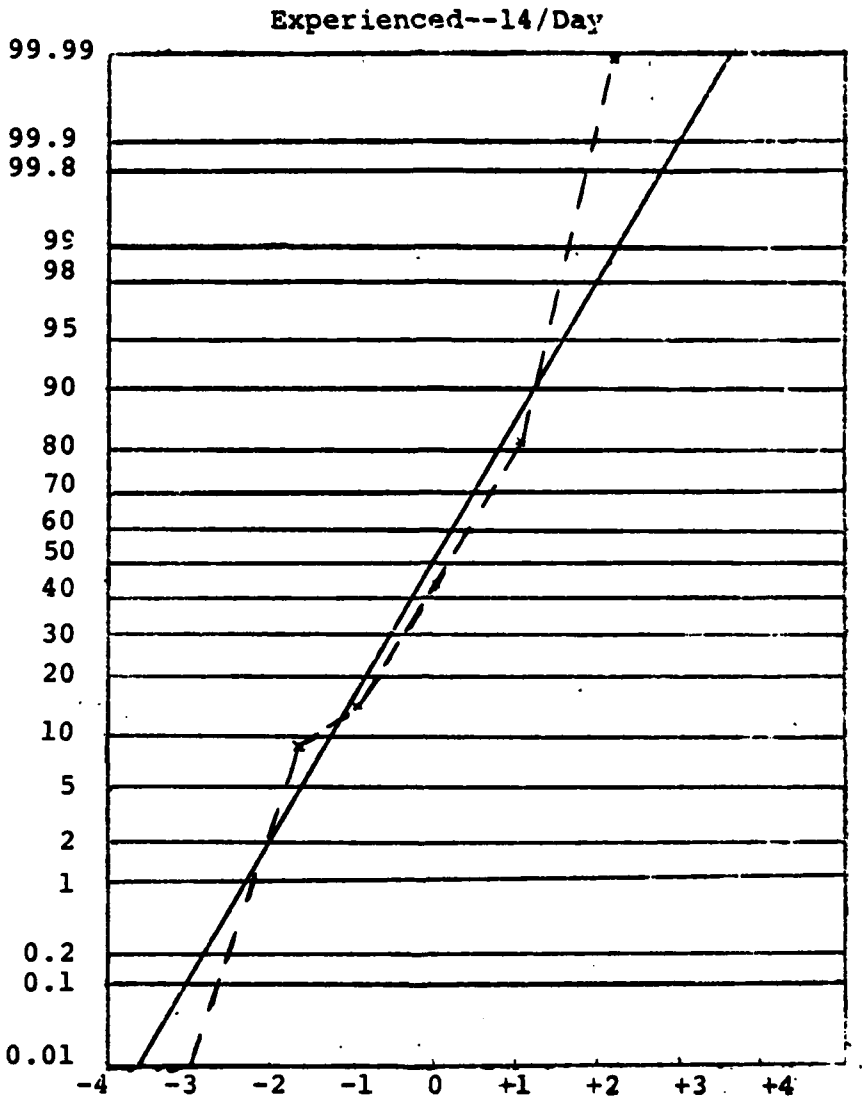
$SSE(R) = 1125.03917$

$F^* = 38.2553$

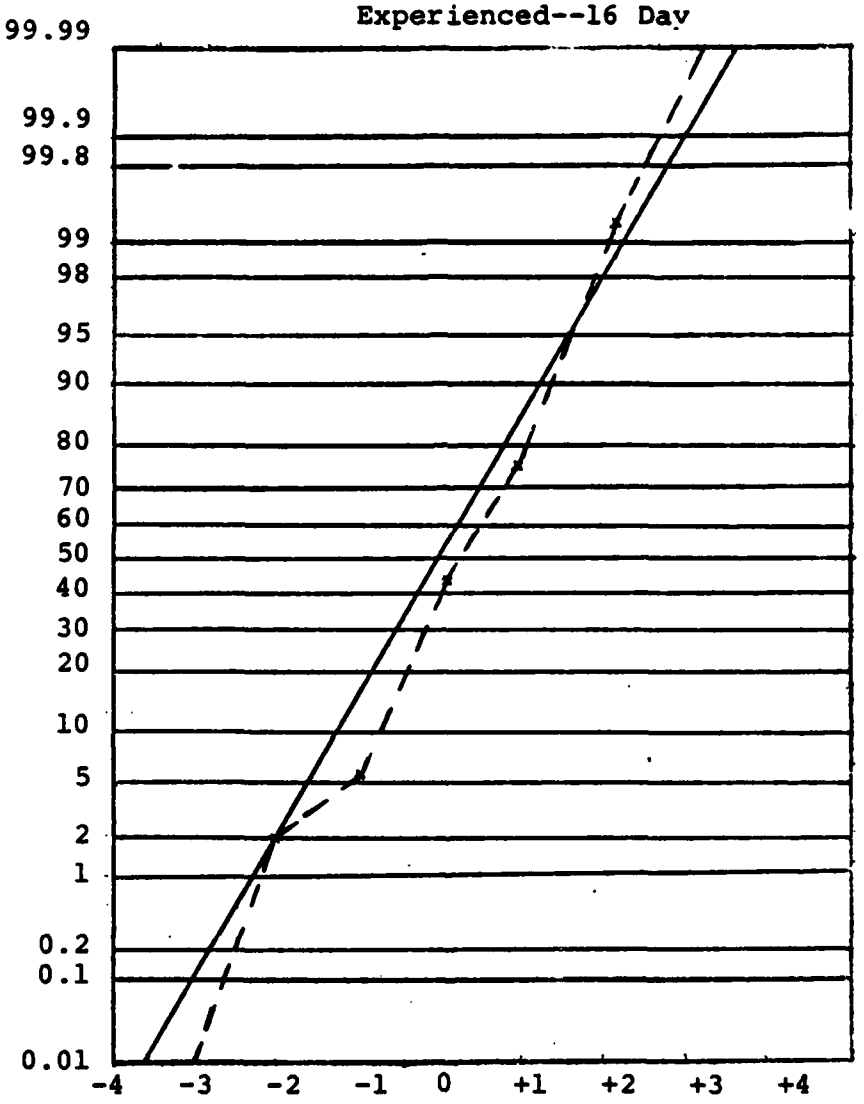
Therefore, reject H_0 and conclude the two lines are different.

Appendix G

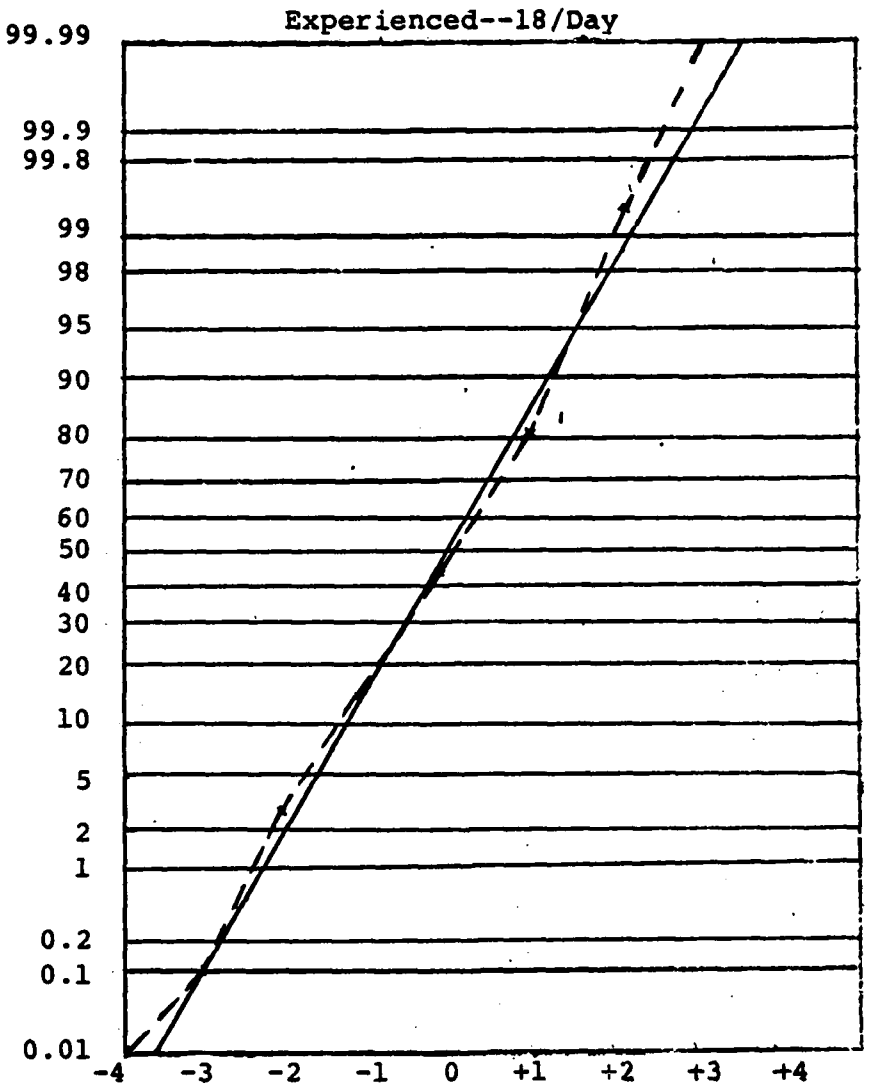
Tests for Normality



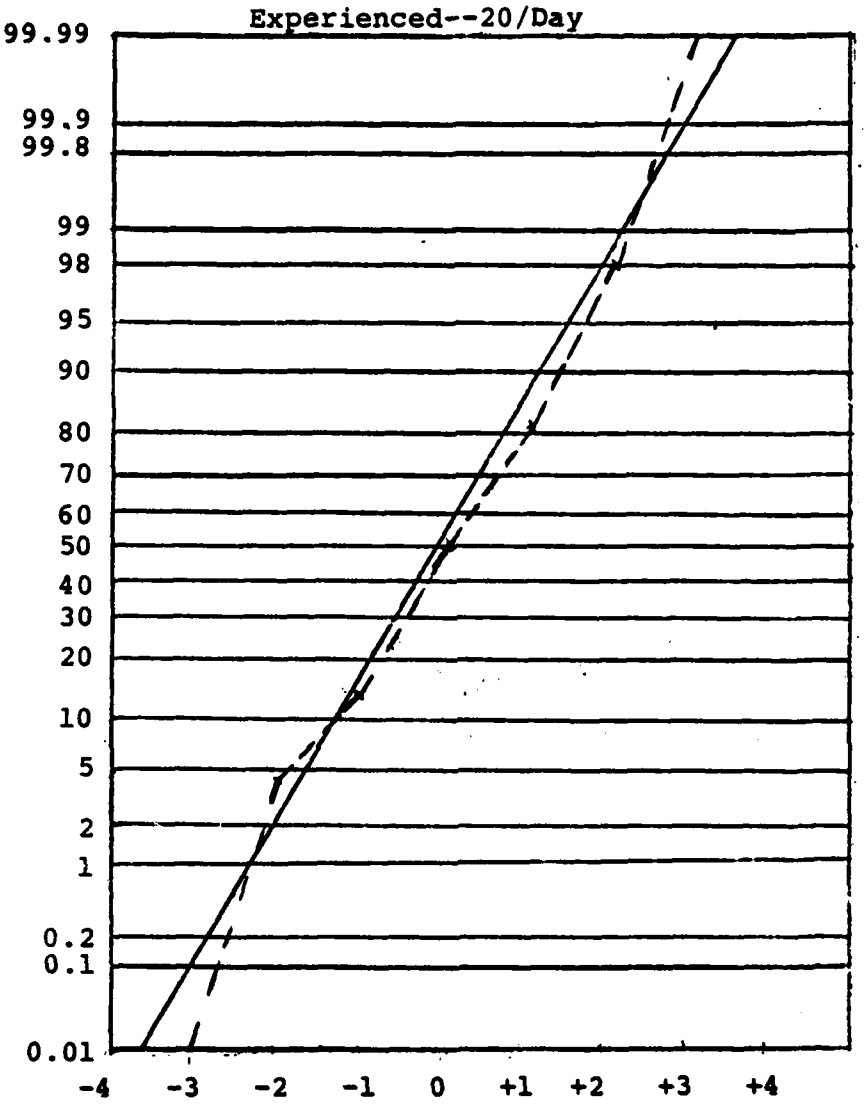
Upper Limit	Number	Percent
-3.0	0	0.0
-2.0	14	4.7
-1.0	32	15.3
0.0	86	44.0
+1.0	112	81.3
+2.0	56	100.0
+3.0	0	100.0



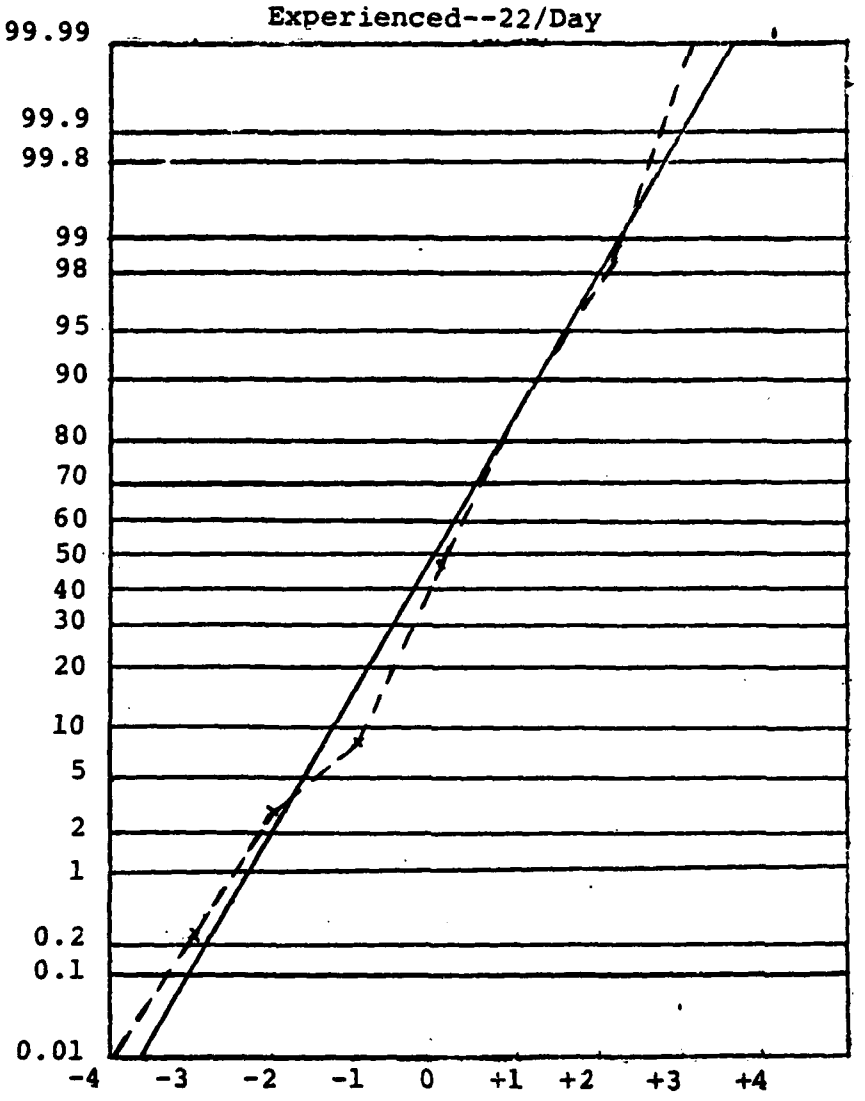
Upper Limit	Number	Percent
-3	0	0.0
-2	6	2.0
-1	12	6.0
0	112	43.3
+1	97	75.6
+2	71	99.3
+3	2	100.0



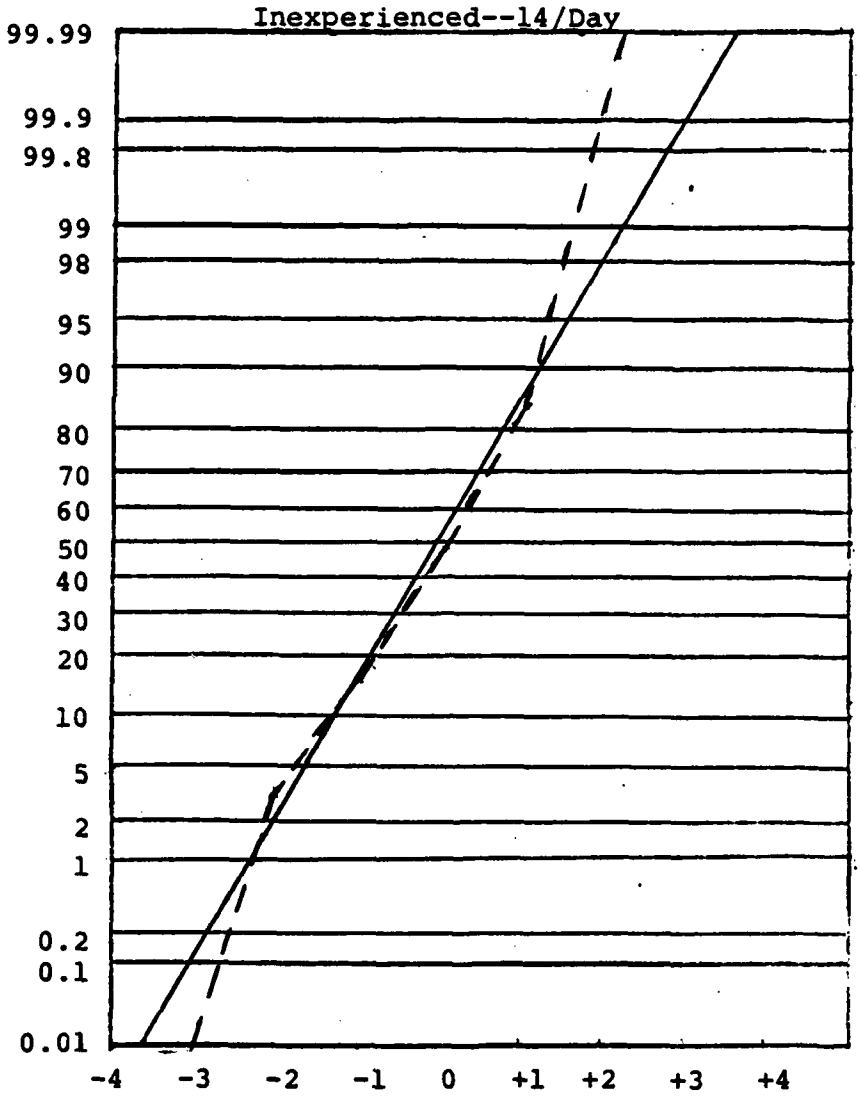
Upper Limit	Number	Percent
-3	3	1.0
-2	6	3.0
-1	39	16.0
0	84	44.0
+1	112	81.3
+2	54	99.3
+3	2	100.0



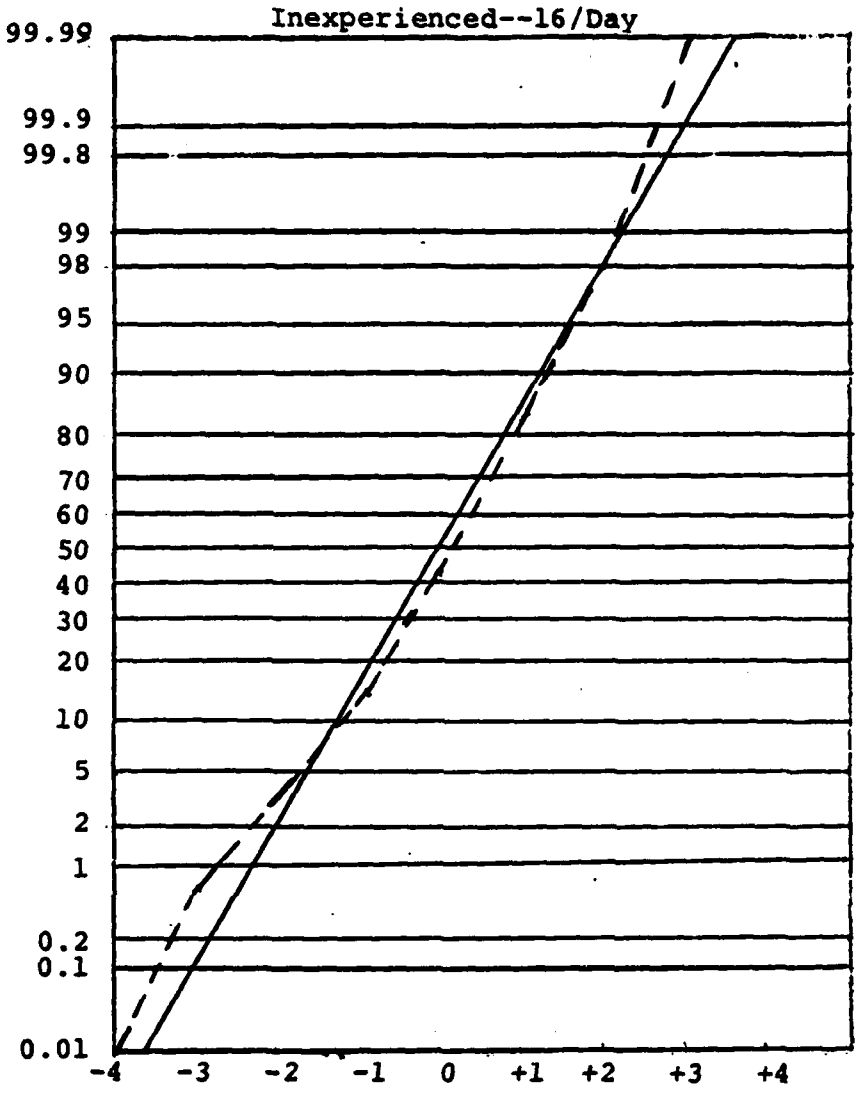
Upper Limit	Number	Percent
-3	0	0.0
-2	12	4.0
-1	30	14.0
0	109	50.3
+1	92	81.0
+2	51	98.0
+3	6	100.0



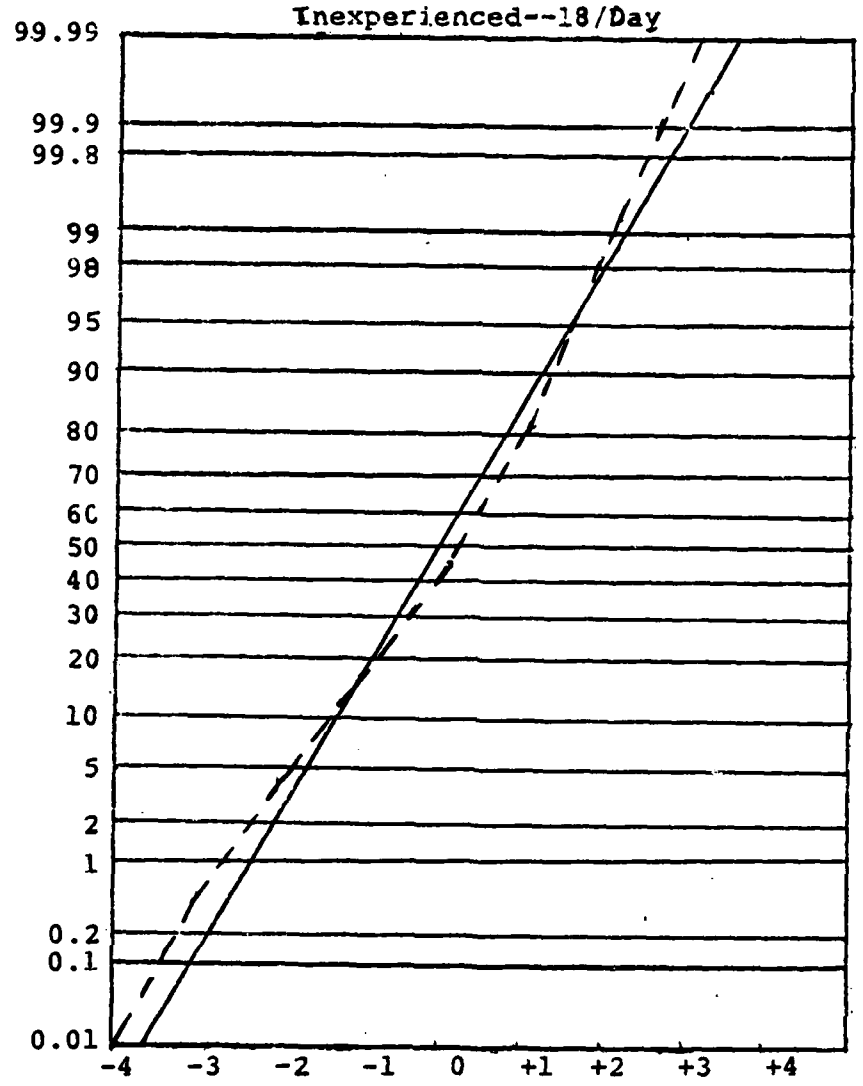
Upper Limit	Number	Percent
-3	1	0.33
-2	9	3.33
-1	16	8.67
0	119	48.33
+1	118	87.67
+2	32	98.33
+3	5	100.00



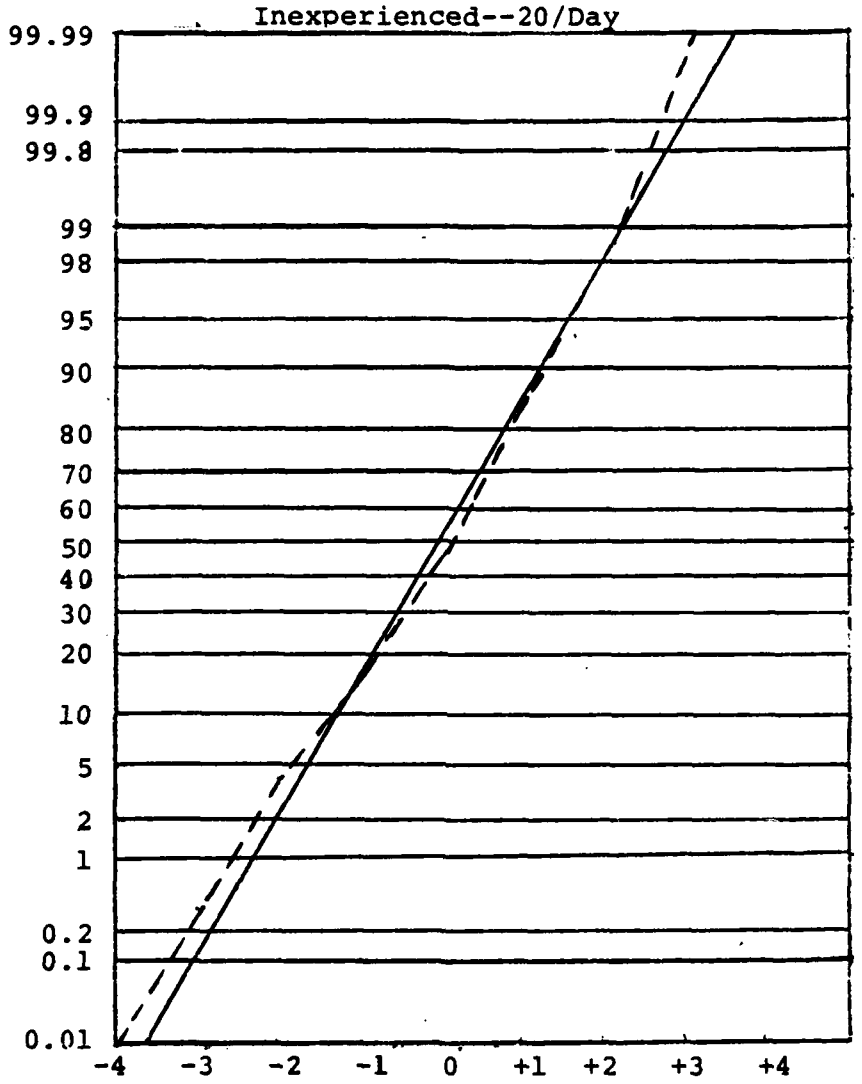
Upper Limit	Number	Percent
-3	0	0.00
-2	11	3.67
-1	42	17.67
0	94	49.00
+1	100	82.33
+2	53	100.00
+3	0	



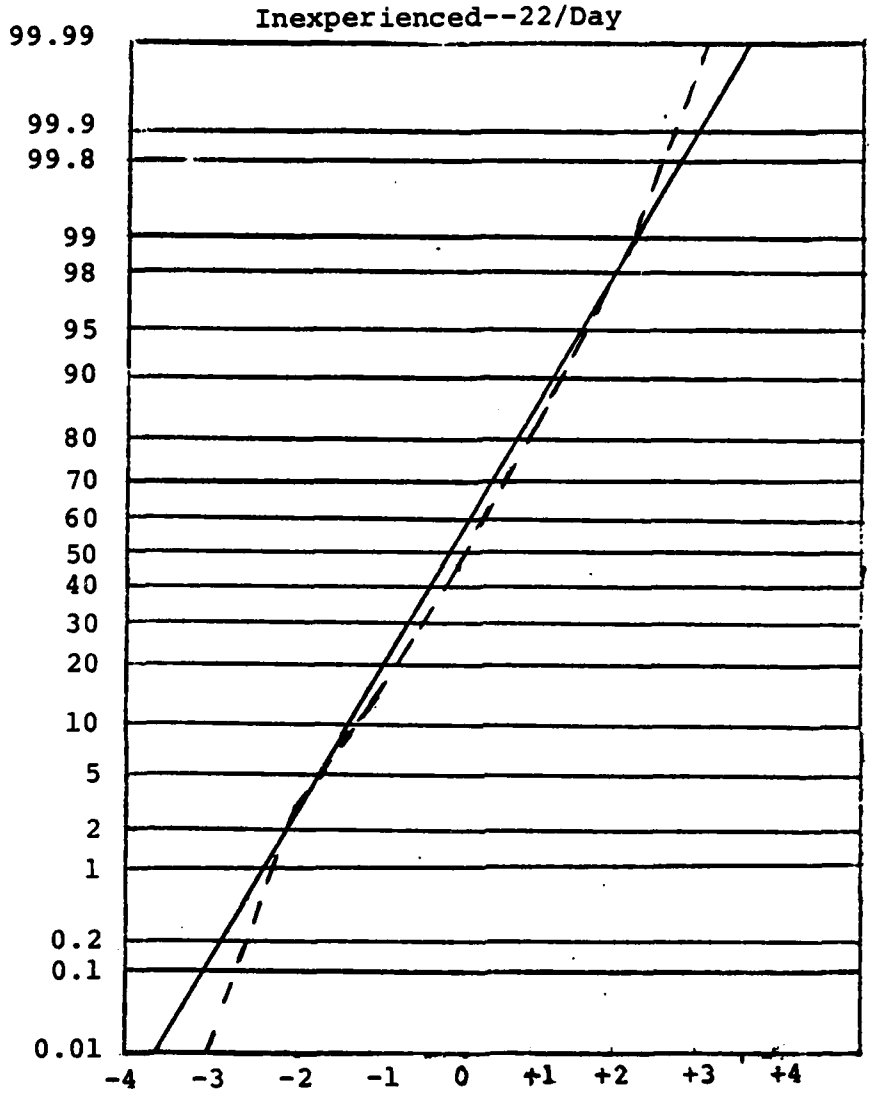
Upper Limit	Number	Percent
-3	2	0.67
-2	9	3.67
-1	32	14.33
0	80	41.00
+1	125	82.67
+2	49	99.00
+3	3	100.00



Upper Limit	Number	Percent
-3	2	0.67
-2	10	4.00
-1	40	17.33
0	77	43.00
+1	113	80.67
+2	56	99.33
+3	2	100.00



Upper Limit	Number	Percent
-3	1	0.33
-2	11	4.00
-1	39	17.00
0	95	48.67
+1	107	84.33
+2	44	99.00
+3	3	100.00



Upper Limit	Number	Percent
-3	0	0.00
-2	8	2.67
-1	35	14.33
0	95	46.00
+1	107	81.67
+2	52	99.00
+3	3	100.00

Residuals for each of the regression lines were run through the Kolmogorov-Smirnov test using the following SPSS format:

```
 100=RUN NAME       K-S TEST FOR EXP-14
110=VARIABLE LIST  X
120=INPUT FORMAT   FREEFIELD
130=NPAR TESTS     K-S (NORMAL,0,1.01883)=X
140=READ INPUT DATA
150=FINISH
```

The only differences between individual programs were the run name and the inputted standard deviation. The results of the Kolmogorov-Smirnov test for each regression line lists the Z value, computed maximum absolute difference, and the resulting two-tailed probability which equals α.

For Experienced at 14 per day

K-S Z = 1.517

MAX ABS DIFF = .0876

α = .020

For Experienced at 16 per day

K-S Z = 1.559

MAX ABS DIFF = .09

α = .016

For Experienced at 18 per day

K-S Z = 1.375

MAX ABS DIFF = .0794

α = .046

For Experienced at 20 per day

K-S Z = 1.165

MAX ABS DIFF = .0672

α = .133

For Experienced at 22 per day

K-S Z = 1.792

MAX ABS DIFF = .1035

α = .003

For Inexperienced at 14 per day

K-S Z = 1.039

MAX ABS DIFF = .06

α = .231

For Inexperienced at 16 per day

K-S Z = 2.101

MAX ABS DIFF = .1213

α = .000

For Inexperienced at 18 per day

K-S Z = 2.567

MAX ABS DIFF = .1534

α = .000

For Inexperienced at 20 per day

K-S Z = 1.712

MAX ABS DIFF = .0988

α = .006

For Inexperienced at 22 per day

K-S Z = .981

MAX ABS DIFF = .0566

α = .291

Appendix H

Test for Constancy of Variance

For each of the regression lines, the data was split in half and separate regression functions were calculated. The mean square errors for each half of a particular regression line were then compared in the following manner:

$$F^* = \frac{S_1^2}{S_2^2}$$

If $F^* > F.95(149,149) \simeq 1.2$, then the null hypothesis is rejected.

For Experienced at 14 sorties per day

S_2^2 = .88303

S_1^2 = 1.22288

F* = 1.044

Therefore, accept H_0.

For Experienced at 16 sorties per day

S_2^2 = 1.12717

S_1^2 = 1.17706

F* = 1.4377

Therefore, reject H_0.

For Experienced at 18 sorties per day

S_2^2 = 1.03403

S_1^2 = 1.48662

F* = 1.4377

Therefore, reject H_0.

For Experienced at 20 sorties per day

$S_1^2 = 1.98504$

$S_2^2 = 1.29102$

$F^* = 1.5376$

Therefore, reject H_0.

For Experienced at 22 sorties per day

$S_2^2 = 1.41546$

$S_1^2 = 2.02597$

$F^* = 1.4313$

Therefore, reject H_0.

For Inexperienced at 14 sorties per day

S_2^2 = .93081

S_1^2 = 1.13055

F* = 1.2146

Therefore, reject H_0.

For Inexperienced at 16 sorties per day

S_2^2 = 1.12828

S_1^2 = 1.23505

F* = 1.0946

Therefore, accept H_0.

For Inexperienced at 18 sorties per day

S_2^2 = 1.06231

S_1^2 = 1.85960

F* = 1.7505

Therefore, reject H_0.

For Inexperienced at 20 sorties per day

$S_2^2 = 2.4792$

$S_1^2 = 1.28847$

$F^* = 1.924$

Therefore, reject H_0.

For Inexperienced at 22 sorties per day

$S_2^2 = 2.10777$

$S_1^2 = 1.28378$

$F^* = 1.6418$

Therefore, reject H_0.

Appendix I

Generated Data

The following data constitutes the basis for all analysis that was conducted in this thesis. Attrition and GCC sorties are listed.

Experienced GCC Sorties at 14/day:

100=	10.0	7
110=	10.0	6
120=	10.0	6
130=	10.0	5
140=	10.0	6
150=	10.0	6
160=	10.0	6
170=	10.0	7
180=	10.0	6
190=	10.0	6
200=	10.0	6
210=	10.0	7
220=	10.0	5
230=	10.0	6
240=	10.0	5
250=	10.0	5
260=	10.0	6
270=	10.0	6
280=	10.0	6
290=	10.0	6
300=	10.0	6
310=	10.0	7
320=	10.0	3
330=	10.0	6
340=	10.0	7
350=	10.0	7
360=	10.0	4
370=	10.0	6
380=	10.0	5
390=	10.0	6
400=	10.0	7
410=	10.0	5
420=	10.0	4
430=	10.0	6
440=	10.0	7
450=	10.0	6
460=	10.0	6
470=	10.0	7
480=	10.0	6
490=	10.0	5
500=	10.0	6
510=	10.0	7
520=	10.0	7
530=	10.0	6
540=	10.0	7
550=	10.0	5
560=	10.0	6
570=	10.0	6
580=	10.0	6
590=	10.0	7
600=	10.0	7

610=	10.0	7	1120=	12.5	5	1630=	15.0	7
620=	10.0	6	1130=	12.5	5	1640=	15.0	6
630=	10.0	6	1140=	12.5	5	1650=	15.0	6
640=	10.0	6	1150=	12.5	4	1660=	15.0	6
650=	10.0	5	1160=	12.5	7	1670=	15.0	5
660=	10.0	6	1170=	12.5	7	1680=	15.0	6
670=	10.0	7	1180=	12.5	5	1690=	15.0	6
680=	10.0	6	1190=	12.5	6	1700=	15.0	5
690=	10.0	6	1200=	12.5	6	1710=	15.0	6
700=	12.5	7	1210=	12.5	6	1720=	15.0	5
710=	12.5	6	1220=	12.5	5	1730=	15.0	4
720=	12.5	7	1230=	12.5	7	1740=	15.0	5
730=	12.5	5	1240=	12.5	5	1750=	15.0	4
740=	12.5	5	1250=	12.5	6	1760=	15.0	7
750=	12.5	6	1260=	12.5	4	1770=	15.0	7
760=	12.5	6	1270=	12.5	6	1780=	15.0	5
770=	12.5	7	1280=	12.5	5	1790=	15.0	6
780=	12.5	6	1290=	12.5	6	1800=	15.0	7
790=	12.5	6	1300=	15.0	7	1810=	15.0	6
800=	12.5	6	1310=	15.0	6	1820=	15.0	5
810=	12.5	6	1320=	15.0	7	1830=	15.0	6
820=	12.5	5	1330=	15.0	6	1840=	15.0	5
830=	12.5	6	1340=	15.0	4	1850=	15.0	6
840=	12.5	4	1350=	15.0	6	1860=	15.0	4
850=	12.5	5	1360=	15.0	4	1870=	15.0	5
860=	12.5	5	1370=	15.0	6	1880=	15.0	5
870=	12.5	7	1380=	15.0	3	890=	15.0	3
880=	12.5	6	1390=	15.0	5	1900=	17.5	7
890=	12.5	6	1400=	15.0	7	1910=	17.5	7
900=	12.5	5	1410=	15.0	6	1920=	17.5	7
910=	12.5	7	1420=	15.0	5	1930=	17.5	6
920=	12.5	4	1430=	15.0	6	1940=	17.5	4
930=	12.5	5	1440=	15.0	5	1950=	17.5	6
940=	12.5	7	1450=	15.0	5	1960=	17.5	4
950=	12.5	6	1460=	15.0	7	1970=	17.5	6
960=	12.5	4	1470=	15.0	6	1980=	17.5	3
970=	12.5	6	1480=	15.0	5	1990=	17.5	4
980=	12.5	5	1490=	15.0	5	2000=	17.5	6
990=	12.5	6	1500=	15.0	4	2010=	17.5	6
1000=	12.5	4	1510=	15.0	6	2020=	17.5	6
1010=	12.5	7	1520=	15.0	6	2030=	17.5	6
1020=	12.5	4	1530=	15.0	4	2040=	17.5	6
1030=	12.5	5	1540=	15.0	5	2050=	17.5	5
1040=	12.5	7	1550=	15.0	5	2060=	17.5	7
1050=	12.5	7	1560=	15.0	7	2070=	17.5	6
1060=	12.5	7	1570=	15.0	5	2080=	17.5	6
1070=	12.5	7	1580=	15.0	6	2090=	17.5	6
1080=	12.5	7	1590=	15.0	5	2100=	17.5	5
1090=	12.5	5	1600=	15.0	5	2110=	17.5	6
1100=	12.5	6	1610=	15.0	5	2120=	17.5	6
1110=	12.5	7	1620=	15.0	4	2130=	17.5	7

2140=	17.5	4
2150=	17.5	6
2160=	17.5	5
2170=	17.5	6
2180=	17.5	6
2190=	17.5	5
2200=	17.5	5
2210=	17.5	5
2220=	17.5	3
2230=	17.5	7
2240=	17.5	6
2250=	17.5	6
2260=	17.5	5
2270=	17.5	5
2280=	17.5	6
2290=	17.5	6
2300=	17.5	3
2310=	17.5	4
2320=	17.5	5
2330=	17.5	4
2340=	17.5	3
2350=	17.5	4
2360=	17.5	7
2370=	17.5	7
2380=	17.5	5
2390=	17.5	6
2400=	17.5	7
2410=	17.5	6
2420=	17.5	5
2430=	17.5	5
2440=	17.5	6
2450=	17.5	5
2460=	17.5	4
2470=	17.5	6
2480=	17.5	5
2490=	17.5	3
500=	20.0	7
2510=	20.0	3
2520=	20.0	5
2530=	20.0	5
2540=	20.0	5
2550=	20.0	5
2560=	20.0	5
2570=	20.0	3
2580=	20.0	5
2590=	20.0	6
2600=	20.0	6
2610=	20.0	6
2620=	20.0	6
2630=	20.0	5
2640=	20.0	5
2650=	20.0	4
2660=	20.0	3
2670=	20.0	5
2680=	20.0	5
2690=	20.0	3
2700=	20.0	6
2710=	20.0	6
2720=	20.0	5
2730=	20.0	5
2740=	20.0	4
2750=	20.0	7
2760=	20.0	6
2770=	20.0	5
2780=	20.0	6
2790=	20.0	7
2800=	20.0	5
2810=	20.0	5
2820=	20.0	5
2830=	20.0	6
2840=	20.0	6
2850=	20.0	7
2860=	20.0	6
2870=	20.0	5
2880=	20.0	7
2890=	20.0	6
2900=	20.0	6
2910=	20.0	6
2920=	20.0	4
2930=	20.0	5
2940=	20.0	7
2950=	20.0	5
2960=	20.0	4
2970=	20.0	4
2980=	20.0	3
2990=	20.0	5
3000=	20.0	5
3010=	20.0	6
3020=	20.0	5
3030=	20.0	6
3040=	20.0	4
3050=	20.0	7
3060=	20.0	3
3070=	20.0	5
3080=	20.0	4
3090=	20.0	5

Experienced GCC Sorties at 16/day:

100=	10.0	8	590=	10.0	7	1080=	12.5	4
110=	10.0	6	600=	10.0	7	1090=	12.5	4
120=	10.0	6	610=	10.0	7	1100=	12.5	6
130=	10.0	6	620=	10.0	8	1110=	12.5	7
140=	10.0	7	630=	10.0	6	1120=	12.5	7
150=	10.0	8	640=	10.0	7	1130=	12.5	8
160=	10.0	7	650=	10.0	8	1140=	12.5	7
170=	10.0	8	660=	10.0	8	1150=	12.5	8
180=	10.0	6	670=	10.0	7	1160=	12.5	5
190=	10.0	8	680=	10.0	8	1170=	12.5	7
200=	10.0	6	690=	10.0	8	1180=	12.5	8
210=	10.0	7	700=	12.5	8	1190=	12.5	6
220=	10.0	8	710=	12.5	7	1200=	12.5	6
230=	10.0	7	720=	12.5	6	1210=	12.5	5
240=	10.0	7	730=	12.5	6	1220=	12.5	8
250=	10.0	7	740=	12.5	7	1230=	12.5	8
260=	10.0	8	750=	12.5	8	1240=	12.5	7
270=	10.0	8	760=	12.5	7	1250=	12.5	8
280=	10.0	6	770=	12.5	8	1260=	12.5	6
290=	10.0	5	780=	12.5	5	1270=	12.5	7
300=	10.0	5	790=	12.5	8	1280=	12.5	7
310=	10.0	8	800=	12.5	5	1290=	12.5	4
320=	10.0	8	810=	12.5	7	1300=	15.0	8
330=	10.0	6	820=	12.5	8	1310=	15.0	7
340=	10.0	6	830=	12.5	7	1320=	15.0	7
350=	10.0	8	840=	12.5	6	1330=	15.0	8
360=	10.0	8	850=	12.5	5	1340=	15.0	7
370=	10.0	6	860=	12.5	8	1350=	15.0	8
380=	10.0	6	870=	12.5	8	1360=	15.0	6
390=	10.0	8	880=	12.5	6	1370=	15.0	4
400=	10.0	7	890=	12.5	5	1380=	15.0	8
410=	10.0	8	900=	12.5	7	1390=	15.0	6
420=	10.0	5	910=	12.5	8	1400=	15.0	7
430=	10.0	7	920=	12.5	7	1410=	15.0	7
440=	10.0	7	930=	12.5	6	1420=	15.0	5
450=	10.0	7	940=	12.5	5	1430=	15.0	6
460=	10.0	8	950=	12.5	7	1440=	15.0	6
470=	10.0	8	960=	12.5	6	1450=	15.0	5
480=	10.0	6	970=	12.5	6	1460=	15.0	8
490=	10.0	7	980=	12.5	5	1470=	15.0	7
500=	10.0	7	990=	12.5	8	1480=	15.0	5
510=	10.0	8	1000=	12.5	7	1490=	15.0	5
520=	10.0	7	1010=	12.5	7	1500=	15.0	7
530=	10.0	7	1020=	12.5	6	1510=	15.0	7
540=	10.0	8	1030=	12.5	7	1520=	15.0	6
550=	10.0	8	1040=	12.5	8	1530=	15.0	6
560=	10.0	7	1050=	12.5	6	1540=	15.0	5
570=	10.0	7	1060=	12.5	5	1550=	15.0	6
580=	10.0	7	1070=	12.5	8	1560=	15.0	6
						1570=	15.0	8

1580= 15.0 6
1590= 15.0 6
1600= 15.0 4
1610= 15.0 7
1620= 15.0 6
1630= 15.0 6
1640= 15.0 5
1650= 15.0 6
1660= 15.0 4
1670= 15.0 6
1680= 15.0 7
1690= 15.0 5
1700= 15.0 7
1710= 15.0 7
1720= 15.0 6
1730= 15.0 5
1740= 15.0 8
1750= 15.0 6
1760= 15.0 5
1770= 15.0 8
1780= 15.0 5
1790= 15.0 7
1800= 15.0 7
1810= 15.0 6
1820= 15.0 6
1830= 15.0 7
1840= 15.0 7
1850= 15.0 6
1860= 15.0 8
1870= 15.0 6
1880= 15.0 7
1890= 15.0 6
900= 17.5 8
1910= 17.5 6
1920= 17.5 7
1930= 17.5 8
1940= 17.5 6
1950= 17.5 8
1960= 17.5 6
1970= 17.5 4
1980= 17.5 8
1990= 17.5 6
2000= 17.5 7
2010= 17.5 6
2020= 17.5 6
2030= 17.5 6
2040= 17.5 5
2050= 17.5 4
2060= 17.5 8
2070= 17.5 7
2080= 17.5 6
2090= 17.5 6
2100= 17.5 4
2110= 17.5 4
2120= 17.5 5
2130= 17.5 7
2140= 17.5 7
2150= 17.5 8
2160= 17.5 6
2170= 17.5 7
2180= 17.5 5
2190= 17.5 7
2200= 17.5 6
2210= 17.5 7
2220= 17.5 6
2230= 17.5 4
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2250= 17.5 5
2260= 17.5 4
2270= 17.5 8
2280= 17.5 6
2290= 17.5 5
2300= 17.5 6
2310= 17.5 5
2320= 17.5 6
2330= 17.5 6
2340= 17.5 8
2350= 17.5 5
2360= 17.5 5
2370= 17.5 7
2380= 17.5 5
2390= 17.5 8
2400= 17.5 7
2410= 17.5 6
2420= 17.5 6
2430= 17.5 7
2440= 17.5 7
2450= 17.5 6
2460= 17.5 7
2470= 17.5 6
2480= 17.5 7
2490= 17.5 5
500= 20.0 7
2510= 20.0 7
2520= 20.0 4
2530= 20.0 7
2540= 20.0 6
2550= 20.0 4
2560= 20.0 6
2570= 20.0 7
2580= 20.0 7
2590= 20.0 5
2600= 20.0 5
2610= 20.0 4
2620= 20.0 6
2630= 20.0 6
2640= 20.0 5
2650= 20.0 7
2660= 20.0 6
2670= 20.0 6
2680= 20.0 6
2690= 20.0 5
2700= 20.0 6
2710= 20.0 6
2720= 20.0 6
2730= 20.0 5
2740= 20.0 8
2750= 20.0 4
2760= 20.0 5
2770= 20.0 7
2780= 20.0 7
2790= 20.0 6
2800= 20.0 6
2810= 20.0 6
2820= 20.0 6
2830= 20.0 6
2840= 20.0 6
2850= 20.0 5
2860= 20.0 6
2870= 20.0 5
2880= 20.0 5
2890= 20.0 7
2900= 20.0 6
2910= 20.0 6
2920= 20.0 7
2930= 20.0 5
2940= 20.0 6
2950= 20.0 6
2960= 20.0 6
2970= 20.0 5
2980= 20.0 6
2990= 20.0 4
3000= 20.0 5
3010= 20.0 7
3020= 20.0 5
3030= 20.0 8
3040= 20.0 7
3050= 20.0 6
3060= 20.0 6
3070= 20.0 5
3080= 20.0 6
3090= 20.0 7

Experienced GCC Sorties at 18/day:

100=	10	8	590=	10	9	1080=	12.5	8	1570=	15	6
110=	10	7	600=	10	8	1090=	12.5	8	1580=	15	6
120=	10	8	610=	10	9	1100=	12.5	8	1590=	15	7
130=	10	7	620=	10	9	1110=	12.5	8	1600=	15	7
140=	10	8	630=	10	7	1120=	12.5	6	1610=	15	8
150=	10	7	640=	10	8	1130=	12.5	8	1620=	15	6
160=	10	5	650=	10	8	1140=	12.5	7	1630=	15	8
170=	10	6	660=	10	9	1150=	12.5	7	1640=	15	5
180=	10	8	670=	10	9	1160=	12.5	9	1650=	15	6
190=	10	7	680=	10	7	1170=	12.5	8	1660=	15	7
200=	10	6	690=	10	9	1180=	12.5	7	1670=	15	8
210=	10	8	700=	12.5	8	1190=	12.5	8	1680=	15	7
220=	10	7	710=	12.5	7	1200=	12.5	8	1690=	15	6
230=	10	9	720=	12.5	8	1210=	12.5	9	1700=	15	6
240=	10	7	730=	12.5	7	1220=	12.5	9	1710=	15	7
250=	10	7	740=	12.5	7	1230=	12.5	7	1720=	15	6
260=	10	9	750=	12.5	7	1240=	12.5	8	1730=	15	7
270=	10	7	760=	12.5	6	1250=	12.5	8	1740=	15	6
280=	10	7	770=	12.5	5	1260=	12.5	9	1750=	15	7
290=	10	7	780=	12.5	8	1270=	12.5	7	1760=	15	8
300=	10	9	790=	12.5	7	1280=	12.5	6	1770=	15	4
310=	10	8	800=	12.5	7	1290=	12.5	6	1780=	15	7
320=	10	9	810=	12.5	8	1300=	15	9	1790=	15	8
330=	10	9	820=	12.5	7	1310=	15	7	1800=	15	9
340=	10	9	830=	12.5	7	1320=	15	7	1810=	15	7
350=	10	8	840=	12.5	7	1330=	15	7	1820=	15	6
360=	10	6	850=	12.5	8	1340=	15	7	1830=	15	7
370=	10	7	860=	12.5	8	1350=	15	6	1840=	15	7
380=	10	8	870=	12.5	7	1360=	15	4	1850=	15	9
390=	10	8	880=	12.5	9	1370=	15	6	1860=	15	9
400=	10	8	890=	12.5	7	1380=	15	8	1870=	15	8
410=	10	7	900=	12.5	6	1390=	15	7	1880=	15	8
420=	10	4	910=	12.5	7	1400=	15	7	1890=	15	5
430=	10	9	920=	12.5	9	1410=	15	7	1900=	17.5	9
440=	10	7	930=	12.5	8	1420=	15	8	1910=	17.5	7
450=	10	8	940=	12.5	7	1430=	15	6	1920=	17.5	7
460=	10	8	950=	12.5	7	1440=	15	6	1930=	17.5	7
470=	10	7	960=	12.5	7	1450=	15	8	1940=	17.5	7
480=	10	9	970=	12.5	8	1460=	15	8	1950=	17.5	6
490=	10	8	980=	12.5	8	1470=	15	7	1960=	17.5	5
500=	10	8	990=	12.5	8	1480=	15	8	1970=	17.5	6
510=	10	8	1000=	12.5	8	1490=	15	7	1980=	17.5	7
520=	10	7	1010=	12.5	7	1500=	15	6	1990=	17.5	8
530=	10	9	1020=	12.5	8	1510=	15	8	2000=	17.5	4
540=	10	8	1030=	12.5	9	1520=	15	9	2010=	17.5	7
550=	10	7	1040=	12.5	8	1530=	15	8	2020=	17.5	8
560=	10	9	1050=	12.5	9	1540=	15	7	2030=	17.5	7
570=	10	8	1060=	12.5	8	1550=	15	6	2040=	17.5	4
580=	10	6	1070=	12.5	7	1560=	15	9	2050=	17.5	7

2060= 17.5 8
2070= 17.5 6
2080= 17.5 8
2090= 17.5 8
2100= 17.5 6
2110= 17.5 7
2120= 17.5 9
2130= 17.5 9
2140= 17.5 7
2150= 17.5 6
2160= 17.5 9
2170= 17.5 7
2180= 17.5 5
2190= 17.5 8
2200= 17.5 8
2210= 17.5 7
2220= 17.5 5
2230= 17.5 7
2240= 17.5 5
2250= 17.5 7
2260= 17.5 5
2270= 17.5 8
2280= 17.5 7
2290= 17.5 6
2300= 17.5 5
2310= 17.5 8
2320= 17.5 8
2330= 17.5 7
2340= 17.5 5
2350= 17.5 7
2360= 17.5 8
2370= 17.5 7
2380= 17.5 6
2390= 17.5 7
2400= 17.5 6
2410= 17.5 8
2420= 17.5 5
2430= 17.5 7
2440= 17.5 6
2450= 17.5 9
2460= 17.5 9
2470= 17.5 8
2480= 17.5 8
2490= 17.5 6
2500= 20 7
2510= 20 8
2520= 20 7
2530= 20 5
2540= 20 8
2550= 20 7
2560= 20 6
2570= 20 5
2580= 20 7
2590= 20 6
2600= 20 7
2610= 20 6
2620= 20 6
2630= 20 6
2640= 20 8
2650= 20 5
2660= 20 7
2670= 20 8
2680= 20 5
2690= 20 8
2700= 20 7
2710= 20 7
2720= 20 8
2730= 20 6
2740= 20 7
2750= 20 7
2760= 20 8
2770= 20 6
2780= 20 7
2790= 20 6
2800= 20 7
2810= 20 6
2820= 20 6
2830= 20 8
2840= 20 7
2850= 20 8
2860= 20 7
2870= 20 8
2880= 20 6
2890= 20 6
2900= 20 8
2910= 20 8
2920= 20 5
2930= 20 4
2940= 20 4
2950= 20 8
2960= 20 8
2970= 20 8
2980= 20 7
2990= 20 6
3000= 20 7
3010= 20 7
3020= 20 9
3030= 20 8
3040= 20 7
3050= 20 8
3060= 20 5
3070= 20 9
3080= 20 7
3090= 20 6

Experienced GCC Sorties at 20/day:

100=	10	7	500=	10	8	1000=	12.5	7	1570=	15	8
110=	10	9	600=	10	10	1090=	12.5	7	1580=	15	9
120=	10	9	610=	10	9	1100=	12.5	7	1590=	15	7
130=	10	9	620=	10	5	1110=	12.5	9	1600=	15	7
140=	10	10	630=	10	9	1120=	12.5	9	1610=	15	7
150=	10	7	640=	10	8	1130=	12.5	7	1620=	15	10
160=	10	9	650=	10	8	1140=	12.5	8	1630=	15	9
170=	10	9	660=	10	8	1150=	12.5	8	1640=	15	8
180=	10	7	670=	10	9	1160=	12.5	8	1650=	15	10
190=	10	8	680=	10	9	1170=	12.5	9	1660=	15	8
200=	10	10	690=	10	10	1180=	12.5	9	1670=	15	6
210=	10	8	700=	12.5	9	1190=	12.5	8	1680=	15	7
220=	10	10	710=	12.5	9	1200=	12.5	8	1690=	15	5
230=	10	8	720=	12.5	9	1210=	12.5	9	1700=	15	9
240=	10	7	730=	12.5	9	1220=	12.5	9	1710=	15	6
250=	10	10	740=	12.5	10	1230=	12.5	7	1720=	15	7
260=	10	10	750=	12.5	7	1240=	12.5	8	1730=	15	7
270=	10	8	760=	12.5	9	1250=	12.5	6	1740=	15	9
280=	10	10	770=	12.5	9	1260=	12.5	8	1750=	15	6
290=	10	10	780=	12.5	7	1270=	12.5	7	1760=	15	8
300=	10	9	790=	12.5	8	1280=	12.5	8	1770=	15	9
310=	10	8	800=	12.5	9	1290=	12.5	8	1780=	15	10
320=	10	8	810=	12.5	6	1300=	15	10	1790=	15	8
330=	10	9	820=	12.5	10	1310=	15	9	1800=	15	8
340=	10	7	830=	12.5	8	1320=	15	8	1810=	15	9
350=	10	9	840=	12.5	7	1330=	15	9	1820=	15	9
360=	10	10	850=	12.5	10	1340=	15	9	1830=	15	7
370=	10	8	860=	12.5	8	1350=	15	9	1840=	15	8
380=	10	7	870=	12.5	7	1360=	15	9	1850=	15	7
390=	10	7	880=	12.5	10	1370=	15	10	1860=	15	7
400=	10	10	890=	12.5	9	1380=	15	8	1870=	15	7
410=	10	8	900=	12.5	9	1390=	15	8	1880=	15	8
420=	10	9	910=	12.5	8	1400=	15	9	1890=	15	7
430=	10	9	920=	12.5	9	1410=	15	6	1900=	17.5	10
440=	10	8	930=	12.5	5	1420=	15	9	1910=	17.5	7
450=	10	10	940=	12.5	8	1430=	15	8	1920=	17.5	8
460=	10	8	950=	12.5	7	1440=	15	6	1930=	17.5	7
470=	10	9	960=	12.5	8	1450=	15	7	1940=	17.5	5
480=	10	9	970=	12.5	8	1460=	15	7	1950=	17.5	8
490=	10	10	980=	12.5	8	1470=	15	10	1960=	17.5	9
500=	10	7	990=	12.5	10	1480=	15	9	1970=	17.5	6
510=	10	8	1000=	12.5	8	1490=	15	9	1980=	17.5	8
520=	10	10	1010=	12.5	7	1500=	15	7	1990=	17.5	5
530=	10	8	1020=	12.5	9	1510=	15	8	2000=	17.5	5
540=	10	9	1030=	12.5	7	1520=	15	5	2010=	17.5	6
550=	10	10	1040=	12.5	8	1530=	15	10	2020=	17.5	8
560=	10	10	1050=	12.5	8	1540=	15	8	2030=	17.5	9
570=	10	8	1060=	12.5	8	1550=	15	9	2040=	17.5	9
580=	10	10	1070=	12.5	7	1560=	15	8	2050=	17.5	8

```
2060=  17.5  7
2070=  17.5  8
2080=  17.5  5
2090=  17.5  9
2100=  17.5  7
2110=  17.5  7
2120=  17.5  6
2130=  17.5  8
2140=  17.5  9
2150=  17.5  8
2160=  17.5  7
2170=  17.5  7
2180=  17.5  6
2190=  17.5  8
2200=  17.5  9
2210=  17.5  7
2220=  17.5  7
2230=  17.5  9
2240=  17.5  8
2250=  17.5  6
2260=  17.5  9
2270=  17.5  9
2280=  17.5  6
2290=  17.5  9
2300=  17.5  7
2310=  17.5  7
2320=  17.5  7
2330=  17.5  5
2340=  17.5  7
2350=  17.5  9
2360=  17.5  8
2370=  17.5  7
2380=  17.5  8
2390=  17.5  10
2400=  17.5  8
2410=  17.5  6
2420=  17.5  7
2430=  17.5  9
2440=  17.5  7
2450=  17.5  8
2460=  17.5  6
2470=  17.5  8
2480=  17.5  7
2490=  17.5  6
2500=  20  8
2510=  20  6
2520=  20  7
2530=  20  5
2540=  20  4
2550=  20  4
2560=  20  7
2570=  20  5
2580=  20  7
2590=  20  6
2600=  20  4
2610=  20  9
2620=  20  10
2630=  20  7
2640=  20  8
2650=  20  7
2660=  20  10
2670=  20  9
2680=  20  5
2690=  20  10
2700=  20  7
2710=  20  6
2720=  20  6
2730=  20  8
2740=  20  9
2750=  20  8
2760=  20  6
2770=  20  7
2780=  20  7
2790=  20  7
2800=  20  9
2810=  20  5
2820=  20  7
2830=  20  9
2840=  20  7
2850=  20  5
2860=  20  9
2870=  20  9
2880=  20  6
2890=  20  8
2900=  20  7
2910=  20  7
2920=  20  7
2930=  20  5
2940=  20  7
2950=  20  8
2960=  20  8
2970=  20  7
2980=  20  8
2990=  20  10
3000=  20  8
3010=  20  6
3020=  20  6
3030=  20  8
3040=  20  8
3050=  20  9
3060=  20  7
3070=  20  5
3080=  20  9
3090=  20  9
3100=*EOR
```

Experienced GCC Sorties at 22/day:

100=	10	10	590=	10	9	1080=	12.5	10	1570=	15	10
110=	10	10	600=	10	10	1090=	12.5	11	1580=	15	8
120=	10	11	610=	10	10	1100=	12.5	8	1590=	15	8
130=	10	10	620=	10	9	1110=	12.5	9	1600=	15	9
140=	10	10	630=	10	11	1120=	12.5	9	1610=	15	9
150=	10	10	640=	10	11	1130=	12.5	10	1620=	15	9
160=	10	9	650=	10	11	1140=	12.5	9	1630=	15	10
170=	10	11	660=	10	11	1150=	12.5	9	1640=	15	8
180=	10	11	670=	10	9	1160=	12.5	11	1650=	15	8
190=	10	9	680=	10	7	1170=	12.5	8	1660=	15	9
200=	10	10	690=	10	8	1180=	12.5	9	1670=	15	8
210=	10	9	700=	12.5	10	1190=	12.5	8	1680=	15	10
220=	10	10	710=	12.5	10	1200=	12.5	10	1690=	15	11
230=	10	10	720=	12.5	9	1210=	12.5	10	1700=	15	8
240=	10	6	730=	12.5	9	1220=	12.5	8	1710=	15	7
250=	10	11	740=	12.5	9	1230=	12.5	11	1720=	15	8
260=	10	10	750=	12.5	9	1240=	12.5	11	1730=	15	8
270=	10	10	760=	12.5	8	1250=	12.5	11	1740=	15	8
280=	10	9	770=	12.5	10	1260=	12.5	11	1750=	15	7
290=	10	10	780=	12.5	11	1270=	12.5	9	1760=	15	11
300=	10	11	790=	12.5	9	1280=	12.5	8	1770=	15	6
310=	10	10	800=	12.5	10	1290=	12.5	8	1780=	15	7
320=	10	11	810=	12.5	10	1300=	15	11	1790=	15	6
330=	10	9	820=	12.5	8	1310=	15	11	1800=	15	11
340=	10	11	830=	12.5	9	1320=	15	8	1810=	15	11
350=	10	10	840=	12.5	6	1330=	15	9	1820=	15	9
360=	10	11	850=	12.5	8	1340=	15	9	1830=	15	8
370=	10	11	860=	12.5	10	1350=	15	10	1840=	15	10
380=	10	10	870=	12.5	8	1360=	15	9	1850=	15	9
390=	10	11	880=	12.5	11	1370=	15	10	1860=	15	8
400=	10	9	890=	12.5	10	1380=	15	11	1870=	15	10
410=	10	11	900=	12.5	9	1390=	15	7	1880=	15	8
420=	10	11	910=	12.5	8	1400=	15	8	1890=	15	8
430=	10	9	920=	12.5	10	1410=	15	9	1900=	17.5	11
440=	10	10	930=	12.5	8	1420=	15	8	1910=	17.5	10
450=	10	11	940=	12.5	10	1430=	15	9	1920=	17.5	8
460=	10	11	950=	12.5	7	1440=	15	5	1930=	17.5	8
470=	10	9	960=	12.5	10	1450=	15	8	1940=	17.5	7
480=	10	11	970=	12.5	10	1460=	15	6	1950=	17.5	11
490=	10	9	980=	12.5	8	1470=	15	11	1960=	17.5	8
500=	10	9	990=	12.5	9	1480=	15	8	1970=	17.5	10
510=	10	9	1000=	12.5	7	1490=	15	8	1980=	17.5	8
520=	10	8	1010=	12.5	9	1500=	15	10	1990=	17.5	7
530=	10	9	1020=	12.5	10	1510=	15	8	2000=	17.5	7
540=	10	9	1030=	12.5	10	1520=	15	9	2010=	17.5	9
550=	10	11	1040=	12.5	10	1530=	15	9	2020=	17.5	7
560=	10	11	1050=	12.5	9	1540=	15	8	2030=	17.5	6
570=	10	8	1060=	12.5	9	1550=	15	9	2040=	17.5	11
580=	10	9	1070=	12.5	8	1560=	15	9	2050=	17.5	8

2060= 17.5 8
2070= 17.5 10
2080= 17.5 7
2090= 17.5 9
2100= 17.5 7
2110= 17.5 7
2120= 17.5 9
2130= 17.5 8
2140= 17.5 11
2150= 17.5 9
2160= 17.5 9
2170= 17.5 7
2180= 17.5 8
2190= 17.5 9
2200= 17.5 9
2210= 17.5 6
2220= 17.5 8
2230= 17.5 9
2240= 17.5 7
2250= 17.5 10
2260= 17.5 7
2270= 17.5 7
2280= 17.5 6
2290= 17.5 9
2300= 17.5 9
2310= 17.5 8
2320= 17.5 9
2330= 17.5 9
2340= 17.5 10
2350= 17.5 11
2360= 17.5 6
2370= 17.5 10
2380= 17.5 7
2390= 17.5 7
2400= 17.5 8
2410= 17.5 8
2420= 17.5 6
2430= 17.5 8
2440= 17.5 10
2450= 17.5 8
2460= 17.5 9
2470= 17.5 9
2480= 17.5 9
2490= 17.5 9
2500= 20 10
2510= 20 10
2520= 20 7
2530= 20 6
2540= 20 7
2550= 20 9
2560= 20 7
2570= 20 9
2580= 20 7
2590= 20 8
2600= 20 6
2610= 20 9
2620= 20 7
2630= 20 5
2640= 20 10
2650= 20 10
2660= 20 7
2670= 20 7
2680= 20 6
2690= 20 9
2700= 20 8
2710= 20 10
2720= 20 10
2730= 20 7
2740= 20 9
2750= 20 7
2760= 20 9
2770= 20 8
2780= 20 5
2790= 20 8
2800= 20 7
2810= 20 6
2820= 20 7
2830= 20 8
2840= 20 9
2850= 20 8
2860= 20 7
2870= 20 7
2880= 20 6
2890= 20 10
2900= 20 6
2910= 20 10
2920= 20 7
2930= 20 9
2940= 20 10
2950= 20 9
2960= 20 7
2970= 20 8
2980= 20 8
2990= 20 9
3000= 20 9
3010= 20 9
3020= 20 9
3030= 20 8
3040= 20 9
3050= 20 4
3060= 20 7
3070= 20 6
3080= 20 7
3090= 20 7

Inexperienced GCC Sorties at 14/day:

100=	10	7	590=	10	6	1080=	12.5	6	1570=	15	5
110=	10	6	600=	10	6	1090=	12.5	6	1580=	15	5
120=	10	7	610=	10	6	1100=	12.5	3	1590=	15	5
130=	10	5	620=	10	6	1110=	12.5	7	1600=	15	4
140=	10	6	630=	10	6	1120=	12.5	5	1610=	15	4
150=	10	7	640=	10	7	1130=	12.5	6	1620=	15	5
160=	10	7	650=	10	5	1140=	12.5	5	1630=	15	6
170=	10	7	660=	10	6	1150=	12.5	4	1640=	15	6
180=	10	7	670=	10	6	1160=	12.5	7	1650=	15	6
190=	10	6	680=	10	6	1170=	12.5	6	1660=	15	6
200=	10	6	690=	10	6	1180=	12.5	6	1670=	15	5
210=	10	7	700=	12.5	7	1190=	12.5	5	1680=	15	5
220=	10	5	710=	12.5	6	1200=	12.5	6	1690=	15	4
230=	10	4	720=	12.5	6	1210=	12.5	7	1700=	15	4
240=	10	4	730=	12.5	5	1220=	12.5	6	1710=	15	6
250=	10	5	740=	12.5	6	1230=	12.5	7	1720=	15	5
260=	10	5	750=	12.5	7	1240=	12.5	7	1730=	15	5
270=	10	6	760=	12.5	7	1250=	12.5	6	1740=	15	6
280=	10	7	770=	12.5	7	1260=	12.5	5	1750=	15	4
290=	10	5	780=	12.5	7	1270=	12.5	6	1760=	15	7
300=	10	5	790=	12.5	6	1280=	12.5	5	1770=	15	6
310=	10	6	800=	12.5	6	1290=	12.5	6	1780=	15	6
320=	10	4	810=	12.5	6	1300=	15	7	1790=	15	5
330=	10	6	820=	12.5	5	1310=	15	6	1800=	15	6
340=	10	6	830=	12.5	4	1320=	15	6	1810=	15	7
350=	10	7	840=	12.5	3	1330=	15	5	1820=	15	6
360=	10	5	850=	12.5	5	1340=	15	5	1830=	15	6
370=	10	7	860=	12.5	5	1350=	15	7	1840=	15	7
380=	10	5	870=	12.5	6	1360=	15	6	1850=	15	6
390=	10	5	880=	12.5	5	1370=	15	7	1860=	15	6
400=	10	6	890=	12.5	5	1380=	15	4	1870=	15	5
410=	10	7	900=	12.5	5	1390=	15	5	1880=	15	5
420=	10	5	910=	12.5	6	1400=	15	5	1890=	15	4
430=	10	6	920=	12.5	4	1410=	15	6	1900=	17.5	7
440=	10	6	930=	12.5	5	1420=	15	5	1910=	17.5	5
450=	10	6	940=	12.5	6	1430=	15	4	1920=	17.5	6
460=	10	6	950=	12.5	7	1440=	15	6	1930=	17.5	5
470=	10	7	960=	12.5	5	1450=	15	6	1940=	17.5	5
480=	10	7	970=	12.5	7	1460=	15	7	1950=	17.5	7
490=	10	4	980=	12.5	5	1470=	15	4	1960=	17.5	5
500=	10	6	990=	12.5	6	1480=	15	5	1970=	17.5	7
510=	10	6	1000=	12.5	3	1490=	15	5	1980=	17.5	4
520=	10	6	1010=	12.5	7	1500=	15	5	1990=	17.5	5
530=	10	5	1020=	12.5	5	1510=	15	7	2000=	17.5	5
540=	10	7	1030=	12.5	6	1520=	15	6	2010=	17.5	7
550=	10	4	1040=	12.5	7	1530=	15	4	2020=	17.5	5
560=	10	6	1050=	12.5	5	1540=	15	5	2030=	17.5	4
570=	10	6	1060=	12.5	6	1550=	15	5	2040=	17.5	6
580=	10	7	1070=	12.5	5	1560=	15	5			

2050=	17.5	6	2530=	20	6	3010=	20	5
2060=	17.5	7	2540=	20	6	3020=	20	4
2070=	17.5	4	2550=	20	4	3030=	20	6
2080=	17.5	5	2560=	20	6	3040=	20	4
2090=	17.5	6	2570=	20	5	3050=	20	6
2100=	17.5	4	2580=	20	7	3060=	20	3
2110=	17.5	5	2590=	20	7	3070=	20	5
2120=	17.5	6	2600=	20	5	3080=	20	4
2130=	17.5	7	2610=	20	7	3090=	20	5
2140=	17.5	5	2620=	20	5			
2150=	17.5	6	2630=	20	6			
2160=	17.5	4	2640=	20	5			
2170=	17.5	6	2650=	20	4			
2180=	17.5	4	2660=	20	4			
2190=	17.5	5	2670=	20	5			
2200=	17.5	6	2680=	20	5			
2210=	17.5	3	2690=	20	3			
2220=	17.5	4	2700=	20	6			
2230=	17.5	6	2710=	20	5			
2240=	17.5	6	2720=	20	5			
2250=	17.5	6	2730=	20	5			
2260=	17.5	6	2740=	20	3			
2270=	17.5	5	2750=	20	6			
2280=	17.5	5	2760=	20	6			
2290=	17.5	4	2770=	20	4			
2300=	17.5	3	2780=	20	6			
2310=	17.5	5	2790=	20	5			
2320=	17.5	5	2800=	20	4			
2330=	17.5	5	2810=	20	4			
2340=	17.5	4	2820=	20	4			
2350=	17.5	4	2830=	20	5			
2360=	17.5	7	2840=	20	6			
2370=	17.5	6	2850=	20	7			
2380=	17.5	5	2860=	20	5			
2390=	17.5	4	2870=	20	5			
2400=	17.5	6	2880=	20	5			
2410=	17.5	5	2890=	20	5			
2420=	17.5	6	2900=	20	7			
2430=	17.5	5	2910=	20	6			
2440=	17.5	6	2920=	20	5			
2450=	17.5	6	2930=	20	7			
2460=	17.5	6	2940=	20	7			
2470=	17.5	6	2950=	20	3			
2480=	17.5	5	2960=	20	4			
2490=	17.5	4	2970=	20	4			
2500=	20	7	2980=	20	5			
2510=	20	3	2990=	20	5			
2520=	20	5	3000=	20	3			

Inexperienced GCC Sorties at 16/day:

100=	10	7	590=	10	7	=	12.5	4	1570=	15	7
110=	10	6	600=	10	6	1090=	12.5	4	1580=	15	6
120=	10	6	610=	10	7	1100=	12.5	6	1590=	15	6
130=	10	7	620=	10	6	1110=	12.5	7	1600=	15	6
140=	10	7	630=	10	4	1120=	12.5	7	1610=	15	6
150=	10	7	640=	10	7	1130=	12.5	7	1620=	15	6
160=	10	8	650=	10	7	1140=	12.5	7	1630=	15	6
170=	10	8	660=	10	8	1150=	12.5	7	1640=	15	4
180=	10	6	670=	10	7	1160=	12.5	7	1650=	15	6
190=	10	8	680=	10	7	1170=	12.5	6	1660=	15	6
200=	10	7	690=	10	6	1180=	12.5	7	1670=	15	5
210=	10	7	700=	12.5	7	1190=	12.5	7	1680=	15	7
220=	10	7	710=	12.5	6	1200=	12.5	6	1690=	15	6
230=	10	8	720=	12.5	6	1210=	12.5	7	1700=	15	7
240=	10	6	730=	12.5	7	1220=	12.5	7	1710=	15	8
250=	10	8	740=	12.5	7	1230=	12.5	6	1720=	15	6
260=	10	7	750=	12.5	7	1240=	12.5	7	1730=	15	6
270=	10	8	760=	12.5	8	1250=	12.5	8	1740=	15	7
280=	10	7	770=	12.5	8	1260=	12.5	6	1750=	15	6
290=	10	5	780=	12.5	6	1270=	12.5	7	1760=	15	5
300=	10	6	790=	12.5	8	1280=	12.5	8	1770=	15	8
310=	10	7	800=	12.5	6	1290=	12.5	5	1780=	15	7
320=	10	7	810=	12.5	7	1300=	15	7	1790=	15	7
330=	10	5	820=	12.5	7	1310=	15	8	1800=	15	8
340=	10	6	830=	12.5	8	1320=	15	7	1810=	15	6
350=	10	6	840=	12.5	6	1330=	15	7	1820=	15	5
360=	10	8	850=	12.5	5	1340=	15	5	1830=	15	7
370=	10	6	860=	12.5	7	1350=	15	8	1840=	15	7
380=	10	7	870=	12.5	8	1360=	15	6	1850=	15	5
390=	10	7	880=	12.5	7	1370=	15	5	1860=	15	6
400=	10	6	890=	12.5	5	1380=	15	6	1870=	15	6
410=	10	7	900=	12.5	5	1390=	15	8	1880=	15	8
420=	10	6	910=	12.5	7	400=	15	6	1890=	15	5
430=	10	7	920=	12.5	7	410=	15	6	1900=	17.5	7
440=	10	8	930=	12.5	5	420=	15	5	1910=	17.5	5
450=	10	7	940=	12.5	4	1430=	15	8	1920=	17.5	7
460=	10	8	950=	12.5	5	1440=	15	6	1930=	17.5	7
470=	10	8	960=	12.5	8	1450=	15	5	1940=	17.5	4
480=	10	6	970=	12.5	5	1460=	15	7	1950=	17.5	8
490=	10	8	980=	12.5	6	1470=	15	7	1960=	17.5	6
500=	10	7	990=	12.5	8	1480=	15	6	1970=	17.5	5
510=	10	6	1000=	12.5	8	1490=	15	4	1980=	17.5	6
520=	10	8	1010=	12.5	7	1500=	15	5	1990=	17.5	8
530=	10	8	1020=	12.5	5	1510=	15	7	2000=	17.5	6
540=	10	7	1030=	12.5	7	1520=	15	7	2010=	17.5	6
550=	10	7	1040=	12.5	7	1530=	15	6	2020=	17.5	5
560=	10	7	1050=	12.5	3	1540=	15	4	2030=	17.5	7
570=	10	8	1060=	12.5	5	1550=	15	4	2040=	17.5	5
580=	10	7	1070=	12.5	7	1560=	15	5	2050=	17.5	6

2060=	17.5	8	2550=	20	7	3040=	20	6
2070=	17.5	6	2560=	20	4	3050=	20	7
2080=	17.5	7	2570=	20	5	3060=	20	7
2090=	17.5	5	2580=	20	6	3070=	20	6
2100=	17.5	5	2590=	20	6	3080=	20	6
2110=	17.5	6	2600=	20	6	3090=	20	6
2120=	17.5	5	2610=	20	6			
2130=	17.5	5	2620=	20	6			
2140=	17.5	5	2630=	20	6			
2150=	17.5	7	2640=	20	2			
2160=	17.5	5	2650=	20	5			
2170=	17.5	7	2660=	20	5			
2180=	17.5	4	2670=	20	8			
2190=	17.5	7	2680=	20	7			
2200=	17.5	7	2690=	20	6			
2210=	17.5	6	2700=	20	7			
2220=	17.5	7	2710=	20	6			
2230=	17.5	4	2720=	20	7			
2240=	17.5	3	2730=	20	6			
2250=	17.5	5	2740=	20	7			
2260=	17.5	4	2750=	20	4			
2270=	17.5	7	2760=	20	5			
2280=	17.5	7	2770=	20	6			
2290=	17.5	5	2780=	20	7			
2300=	17.5	6	2790=	20	5			
2310=	17.5	5	2800=	20	5			
2320=	17.5	5	2810=	20	7			
2330=	17.5	5	2820=	20	6			
2340=	17.5	7	2830=	20	6			
2350=	17.5	6	2840=	20	6			
2360=	17.5	5	2850=	20	5			
2370=	17.5	7	2860=	20	6			
2380=	17.5	6	2870=	20	6			
2390=	17.5	6	2880=	20	4			
2400=	17.5	8	2890=	20	5			
2410=	17.5	6	2900=	20	5			
2420=	17.5	5	2910=	20	4			
2430=	17.5	7	2920=	20	6			
2440=	17.5	7	2930=	20	6			
2450=	17.5	5	2940=	20	6			
2460=	17.5	6	2950=	20	5			
2470=	17.5	6	2960=	20	6			
2480=	17.5	7	2970=	20	6			
2490=	17.5	5	2980=	20	7			
2500=	20	7	2990=	20	4			
2510=	20	5	3000=	20	5			
2520=	20	6	3010=	20	7			
2530=	20	8	3020=	20	4			
2540=	20	7	3030=	20	8			

Inexperienced GCC Sorties at 18/day:

100= 10 9	590= 10 9	1080= 12.5 7	1570= 15 8
110= 10 8	600= 10 9	1090= 12.5 7	1580= 15 6
120= 10 8	610= 10 9	1100= 12.5 9	1590= 15 5
130= 10 6	620= 10 9	1110= 12.5 8	1600= 15 7
140= 10 8	630= 10 8	1120= 12.5 7	1610= 15 4
150= 10 7	640= 10 8	1130= 12.5 8	1620= 15 6
160= 10 6	650= 10 8	1140= 12.5 6	1630= 15 5
170= 10 8	660= 10 9	1150= 12.5 8	1640= 15 6
180= 10 8	670= 10 9	1160= 12.5 8	1650= 15 6
190= 10 8	680= 10 7	1170= 12.5 8	1660= 15 7
200= 10 7	690= 10 8	1180= 12.5 8	1670= 15 6
210= 10 8	700= 12.5 9	1190= 12.5 8	1680= 15 5
220= 10 8	710= 12.5 8	1200= 12.5 8	1690= 15 7
230= 10 9	720= 12.5 8	1210= 12.5 9	1700= 15 7
240= 10 7	730= 12.5 6	1220= 12.5 9	1710= 15 9
250= 10 8	740= 12.5 8	1230= 12.5 8	1720= 15 8
260= 10 8	750= 12.5 7	1240= 12.5 8	1730= 15 6
270= 10 7	760= 12.5 6	1250= 12.5 8	1740= 15 8
280= 10 7	770= 12.5 6	1260= 12.5 9	1750= 15 7
290= 10 6	780= 12.5 8	1270= 12.5 7	1760= 15 5
300= 10 8	790= 12.5 8	1280= 12.5 7	1770= 15 8
310= 10 7	800= 12.5 5	1290= 12.5 7	1780= 15 8
320= 10 7	810= 12.5 7	1300= 15 8	1790= 15 8
330= 10 8	820= 12.5 8	1310= 15 7	1800= 15 8
340= 10 9	830= 12.5 6	1320= 15 7	1810= 15 5
350= 10 8	840= 12.5 7	1330= 15 5	1820= 15 7
360= 10 6	850= 12.5 9	1340= 15 8	1830= 15 8
370= 10 9	860= 12.5 8	1350= 15 7	1840= 15 7
380= 10 8	870= 12.5 7	1360= 15 4	1850= 15 9
390= 10 8	880= 12.5 8	1370= 15 6	1860= 15 8
400= 10 8	890= 12.5 6	1380= 15 8	1870= 15 6
410= 10 5	900= 12.5 9	1390= 15 8	1880= 15 7
420= 10 6	910= 12.5 7	1400= 15 5	1890= 15 5
430= 10 7	920= 12.5 9	1410= 15 6	1900= 17.5 8
440= 10 8	930= 12.5 8	1420= 15 8	1910= 17.5 7
450= 10 8	940= 12.5 8	1430= 15 6	1920= 17.5 7
460= 10 7	950= 12.5 8	1440= 15 7	1930= 17.5 5
470= 10 7	960= 12.5 8	1450= 15 8	1940= 17.5 8
480= 10 7	970= 12.5 9	1460= 15 8	1950= 17.5 5
490= 10 7	980= 12.5 8	1470= 15 6	1960= 17.5 4
500= 10 9	990= 12.5 7	1480= 15 7	1970= 17.5 6
510= 10 8	1000= 12.5 8	1490= 15 6	1980= 17.5 8
520= 10 7	1010= 12.5 6	1500= 15 8	1990= 17.5 7
530= 10 9	1020= 12.5 8	1510= 15 7	2000= 17.5 3
540= 10 6	1030= 12.5 6	1520= 15 9	2010= 17.5 6
550= 10 8	1040= 12.5 8	1530= 15 8	2020= 17.5 8
560= 10 8	1050= 12.5 7	1540= 15 8	2030= 17.5 6
570= 10 8	1060= 12.5 7	1550= 15 8	2040= 17.5 5
580= 10 8	1070= 12.5 7	1560= 15 9	2050= 17.5 8

2060= 17.5 7
2070= 17.5 6
2080= 17.5 7
2090= 17.5 5
2100= 17.5 7
2110= 17.5 6
2120= 17.5 9
2130= 17.5 7
2140= 17.5 7
2150= 17.5 7
2160= 17.5 9
2170= 17.5 8
2180= 17.5 6
2190= 17.5 7
2200= 17.5 4
2210= 17.5 7
2220= 17.5 3
2230= 17.5 7
2240= 17.5 7
2250= 17.5 5
2260= 17.5 6
2270= 17.5 7
2280= 17.5 6
2290= 17.5 5
2300= 17.5 7
2310= 17.5 8
2320= 17.5 7
2330= 17.5 8
2340= 17.5 6
2350= 17.5 6
2360= 17.5 7
2370= 17.5 8
2380= 17.5 5
2390= 17.5 9
2400= 17.5 8
2410= 17.5 7
2420= 17.5 7
2430= 17.5 8
2440= 17.5 6
2450= 17.5 9
2460= 17.5 8
2470= 17.5 6
2480= 17.5 7
2490= 17.5 4
2500= 20 7
2510= 20 7
2520= 20 7
2530= 20 5
2540= 20 8
2550= 20 7
2560= 20 8
2570= 20 7
2580= 20 6
2590= 20 5
2600= 20 7
2610= 20 8
2620= 20 5
2630= 20 7
2640= 20 7
2650= 20 4
2660= 20 5
2670= 20 8
2680= 20 5
2690= 20 8
2700= 20 8
2710= 20 7
2720= 20 6
2730= 20 5
2740= 20 8
2750= 20 8
2760= 20 6
2770= 20 6
2780= 20 8
2790= 20 8
2800= 20 6
2810= 20 6
2820= 20 5
2830= 20 9
2840= 20 5
2850= 20 7
2860= 20 8
2870= 20 8
2880= 20 5
2890= 20 6
2900= 20 7
2910= 20 6
2920= 20 4
2930= 20 6
2940= 20 3
2950= 20 9
2960= 20 7
2970= 20 7
2980= 20 6
2990= 20 4
3000= 20 7
3010= 20 8
3020= 20 8
3030= 20 5
3040= 20 8
3050= 20 7
3060= 20 6
3070= 20 7
3080= 20 7
3090= 20 7

Inexperienced GCC Sorties at 20/day:

100= 10 9	590= 10 8	1080= 12.5 7	1570= 15 6
110= 10 9	600= 10 10	1090= 12.5 7	1580= 15 9
120= 10 8	610= 10 9	1100= 12.5 9	1590= 15 7
130= 10 9	620= 10 7	1110= 12.5 9	1600= 15 7
140= 10 9	630= 10 9	1120= 12.5 9	1610= 15 8
150= 10 5	640= 10 7	1130= 12.5 7	1620= 15 8
160= 10 10	650= 10 8	1140= 12.5 9	1630= 15 7
170= 10 8	660= 10 8	1150= 12.5 7	1640= 15 8
180= 10 7	670= 10 10	1160= 12.5 8	1650= 15 9
190= 10 7	680= 10 9	1170= 12.5 8	1660= 15 9
200= 10 9	690= 10 9	1180= 12.5 9	1670= 15 7
210= 10 9	700= 12.5 9	1190= 12.5 8	1680= 15 7
220= 10 9	710= 12.5 9	1200= 12.5 7	1690= 15 7
230= 10 8	720= 12.5 8	1210= 12.5 8	1700= 15 10
240= 10 9	730= 12.5 9	1220= 12.5 8	1710= 15 7
250= 10 10	740= 12.5 9	1230= 12.5 8	1720= 15 7
260= 10 10	750= 12.5 5	1240= 12.5 8	1730= 15 5
270= 10 7	760= 12.5 10	1250= 12.5 6	1740= 15 10
280= 10 9	770= 12.5 8	1260= 12.5 10	1750= 15 5
290= 10 9	780= 12.5 7	1270= 12.5 8	1760= 15 9
300= 10 9	790= 12.5 7	1280= 12.5 8	1770= 15 8
310= 10 9	800= 12.5 8	1290= 12.5 9	1780= 15 10
320= 10 7	810= 12.5 9	1300= 15 8	1790= 15 7
330= 10 9	820= 12.5 9	1310= 15 9	1800= 15 8
340= 10 8	830= 12.5 8	1320= 15 8	1810= 15 9
350= 10 8	840= 12.5 9	1330= 15 9	1820= 15 8
360= 10 10	850= 12.5 10	1340= 15 9	1830= 15 8
370= 10 7	860= 12.5 8	1350= 15 6	1840= 15 8
380= 10 6	870= 12.5 6	1360= 15 10	1850= 15 6
390= 10 8	880= 12.5 9	1370= 15 7	1860= 15 10
400= 10 9	890= 12.5 9	1380= 15 7	1870= 15 8
410= 10 8	900= 12.5 9	1390= 15 7	1880= 15 8
420= 10 10	910= 12.5 7	1400= 15 8	1890= 15 9
430= 10 9	920= 12.5 7	1410= 15 8	1900= 17.5 8
440= 10 9	930= 12.5 7	1420= 15 8	1910= 17.5 7
450= 10 10	940= 12.5 8	1430= 15 9	1920= 17.5 7
460= 10 9	950= 12.5 7	1440= 15 7	1930= 17.5 6
470= 10 9	960= 12.5 8	1450= 15 7	1940= 17.5 6
480= 10 9	970= 12.5 6	1460= 15 6	1950= 17.5 9
490= 10 10	980= 12.5 9	1470= 15 9	1960= 17.5 8
500= 10 6	990= 12.5 9	1480= 15 10	1970= 17.5 7
510= 10 9	1000= 12.5 8	1490= 15 8	1980= 17.5 9
520= 10 9	1010= 12.5 9	1500= 15 6	1990= 17.5 4
530= 10 9	1020= 12.5 8	1510= 15 6	2000= 17.5 5
540= 10 10	1030= 12.5 8	1520= 15 5	2010= 17.5 8
550= 10 10	1040= 12.5 8	1530= 15 8	2020= 17.5 8
560= 10 9	1050= 12.5 8	1540= 15 8	2030= 17.5 8
570= 10 7	1060= 12.5 8	1550= 15 6	2040= 17.5 10
580= 10 9	1070= 12.5 6	1560= 15 8	2050= 17.5 8

```
2060=  1 ..  7
2070=  17.5  6
2080=  17.5  3
2090=  17.5  7
2100=  17.5  6
2110=  17.5  6
2120=  17.5  6
2130=  17.5  8
2140=  17.5  7
2150=  17.5  7
2160=  17.5  7
2170=  17.5  8
2180=  17.5  8
2190=  17.5  9
2200=  17.5  10
2210=  17.5  6
2220=  17.5  7
2230=  17.5  8
2240=  17.5  9
2250=  17.5  6
2260=  17.5  10
2270=  17.5  10
2280=  17.5  7
2290=  17.5  9
2300=  17.5  10
2310=  17.5  9
2320=  17.5  4
2330=  17.5  5
2340=  17.5  6
2350=  17.5  8
2360=  17.5  8
2370=  17.5  6
2380=  17.5  9
2390=  17.5  9
2400=  17.5  8
2410=  17.5  7
2420=  17.5  8
2430=  17.5  9
2440=  17.5  9
2450=  17.5  7
2460=  17.5  7
2470=  17.5  6
2480=  17.5  8
2490=  17.5  7
2500=  20  6
2510=  20  6
2520=  20  7
2530=  20  3
2540=  20  5
2550=  20  2
2560=  20  7
2570=  20  6
2580=  20  9
2590=  20  7
2600=  20  6
2610=  20  7
2620=  20  9
2630=  20  8
2640=  20  7
2650=  20  8
2660=  20  9
2670=  20  7
2680=  20  3
2690=  20  7
2700=  20  6
2710=  20  5
2720=  20  6
2730=  20  8
2740=  20  7
2750=  20  7
2760=  20  7
2770=  20  8
2780=  20  8
2790=  20  9
2800=  20  10
2810=  20  5
2820=  20  7
2830=  20  8
2840=  20  9
2850=  20  6
2860=  20  10
2870=  20  8
2880=  20  7
2890=  20  8
2900=  20  10
2910=  20  9
2920=  20  4
2930=  20  5
2940=  20  6
2950=  20  7
2960=  20  8
2970=  20  6
2980=  20  9
2990=  20  9
3000=  20  8
3010=  20  8
3020=  20  6
3030=  20  8
3040=  20  7
3050=  20  8
3060=  20  8
3070=  20  5
3080=  20  8
3090=  20  9
```

Inexperienced GCC Sorties at 22/day:

100=	10	11	590=	10	9	1080=	12.5	10	1570=	15	10
110=	10	10	600=	10	8	1090=	12.5	9	1580=	15	8
120=	10	10	610=	10	8	1100=	12.5	9	1590=	15	8
130=	10	9	620=	10	8	1110=	12.5	8	1600=	15	6
140=	10	7	630=	10	10	1120=	12.5	10	1610=	15	8
150=	10	9	640=	10	10	1130=	12.5	9	1620=	15	7
160=	10	9	650=	10	10	1140=	12.5	8	1630=	15	10
170=	10	11	660=	10	11	1150=	12.5	9	1640=	15	8
180=	10	10	670=	10	9	1160=	12.5	10	1650=	15	7
190=	10	9	680=	10	9	1170=	12.5	8	1660=	15	11
200=	10	9	690=	10	9	1180=	12.5	10	1670=	15	8
210=	10	8	700=	12.5	11	1190=	12.5	8	1680=	15	10
220=	10	7	710=	12.5	10	1200=	12.5	8	1690=	15	9
230=	10	7	720=	12.5	10	1210=	12.5	8	1700=	15	9
240=	10	7	730=	12.5	9	1220=	12.5	8	1710=	15	6
250=	10	10	740=	12.5	6	1230=	12.5	10	1720=	15	9
260=	10	10	750=	12.5	8	1240=	12.5	10	1730=	15	8
270=	10	7	760=	12.5	9	1250=	12.5	10	1740=	15	8
280=	10	9	770=	12.5	10	1260=	12.5	11	1750=	15	7
290=	10	10	780=	12.5	10	1270=	12.5	9	1760=	15	10
300=	10	11	790=	12.5	9	1280=	12.5	8	1770=	15	6
310=	10	10	800=	12.5	8	1290=	12.5	9	1780=	15	7
320=	10	11	810=	12.5	9	1300=	15	10	1790=	15	7
330=	10	9	820=	12.5	9	1310=	15	10	1800=	15	9
340=	10	11	830=	12.5	9	1320=	15	9	1810=	15	10
350=	10	9	840=	12.5	9	1330=	15	9	1820=	15	10
360=	10	10	850=	12.5	9	1340=	15	6	1830=	15	8
370=	10	9	860=	12.5	10	1350=	15	8	1840=	15	9
380=	10	8	870=	12.5	10	1360=	15	8	1850=	15	10
390=	10	11	880=	12.5	10	1370=	15	10	1860=	15	7
400=	10	9	890=	12.5	9	1380=	15	10	1870=	15	10
410=	10	8	900=	12.5	8	1390=	15	9	1880=	15	8
420=	10	10	910=	12.5	8	1400=	15	6	1890=	15	9
430=	10	11	920=	12.5	8	1410=	15	8	1900=	17.5	10
440=	10	10	930=	12.5	8	1420=	15	9	1910=	17.5	10
450=	10	10	940=	12.5	9	1430=	15	9	1920=	17.5	9
460=	10	11	950=	12.5	6	1440=	15	8	1930=	17.5	7
470=	10	9	960=	12.5	10	1450=	15	9	1940=	17.5	6
480=	10	9	970=	12.5	10	1460=	15	8	1950=	17.5	10
490=	10	9	980=	12.5	9	1470=	15	10	1960=	17.5	8
500=	10	9	990=	12.5	9	1480=	15	9	1970=	17.5	10
510=	10	8	1000=	12.5	7	1490=	15	7	1980=	17.5	7
520=	10	11	1010=	12.5	9	1500=	15	9	1990=	17.5	10
530=	10	9	1020=	12.5	8	1510=	15	8	2000=	17.5	9
540=	10	8	1030=	12.5	10	1520=	15	11	2010=	17.5	10
550=	10	11	1040=	12.5	9	1530=	15	9	2020=	17.5	9
560=	10	10	1050=	12.5	8	1540=	15	7	2030=	17.5	7
570=	10	9	1060=	12.5	11	1550=	15	9	2040=	17.5	11
580=	10	10	1070=	12.5	10	1560=	15	9	2050=	17.5	7

2060= 17.5 7
2070= 17.5 10
2080= 17.5 8
2090= 17.5 9
2100= 17.5 6
2110= 17.5 8
2120= 17.5 11
2130= 17.5 7
2140= 17.5 10
2150= 17.5 10
2160= 17.5 9
2170= 17.5 8
2180= 17.5 10
2190= 17.5 7
2200= 17.5 9
2210= 17.5 7
2220= 17.5 7
2230= 17.5 9
2240= 17.5 7
2250= 17.5 9
2260= 17.5 7
2270= 17.5 5
2280= 17.5 7
2290= 17.5 9
2300= 17.5 8
2310= 17.5 9
2320= 17.5 10
2330= 17.5 9
2340= 17.5 10
2350= 17.5 10
2360= 17.5 7
2370= 17.5 10
2380= 17.5 7
2390= 17.5 7
2400= 17.5 7
2410= 17.5 8
2420= 17.5 7
2430= 17.5 8
2440= 17.5 8
2450= 17.5 9
2460= 17.5 8
2470= 17.5 10
2480= 17.5 8
2490= 17.5 7
2500= 20 9
2510= 20 10
2520= 20 8
2530= 20 7
2540= 20 6
2550= 20 9
2560= 20 6
2570= 20 10
2580= 20 7
2590= 20 8
2600= 20 8
2610= 20 10
2620= 20 9
2630= 20 7
2640= 20 10
2650= 20 8
2660= 20 7
2670= 20 10
2680= 20 8
2690= 20 8
2700= 20 7
2710= 20 11
2720= 20 6
2730= 20 8
2740= 20 9
2750= 20 8
2760= 20 7
2770= 20 7
2780= 20 5
2790= 20 8
2800= 20 5
2810= 20 5
2820= 20 9
2830= 20 6
2840= 20 7
2850= 20 7
2860= 20 10
2870= 20 6
2880= 20 5
2890= 20 7
2900= 20 8
2910= 20 9
2920= 20 7
2930= 20 8
2940= 20 8
2950= 20 7
2960= 20 7
2970= 20 9
2980= 20 7
2990= 20 10
3000= 20 6
3010= 20 9
3020= 20 9
3030= 20 7
3040= 20 7
3050= 20 4
3060= 20 9
3070= 20 8
3080= 20 8
3090= 20 7

Appendix J

Interactive Model for Sortie Rates

The following program is used to determine sortie rates:

```
100=      PROGRAM SORTRAT(INPUT,OUTPUT)
110=      REAL ATRATE,DAYS,EXSQ,INEXSQ,GCCLEV,RATEX
120=      REAL RATIN,EXSORT(5),INSORT(5),X,Y
130=      DATA ATRATE,DAYS,EXSQ,INEXSQ,RATEX,RATIN
140=     1/0.,0.,0.,0.,0.,0./
150=      DATA X,Y/0.,0./
160=      GCCLEV=0.
170=      DATA EXSORT,INSORT/5*0.,5*0./
180=      PRINT *,'   THIS PROGRAM IS DESIGNED TO CALCULATE'
190=      PRINT *,'  THE MOST EFFICIENT SORTIE RATE TO ACHIEVE'
200=      PRINT *,'  A PREDETERMINED GCC LEVEL.'
210=      PRINT *,
220=      PRINT *,
230=      PRINT *,
240=      PRINT *,'   HOW MANY DAYS REMAIN IN THE CYCLE?'
250=      PRINT *,
260=      READ *,DAYS
270=      PRINT *,
280=      PRINT *,
290=      PRINT *,
300=      PRINT *,'   ENTER ACCOMPLISHED EXPERIENCED SORTIES'
310=      PRINT *,
320=      READ *,EXSQ
330=      PRINT *,
340=      PRINT *,'   ENTER ACCOMPLISHED INEXPERIENCED SORTIES'
350=      PRINT *,
360=      READ *,INEXSQ
370=      PRINT *,
380=      PRINT *,
390=      PRINT *,'   WHAT GCC LEVEL DO YOU DESIRE?'
400=      PRINT *,'   REMEMBER THAT A=1.,B=2.,C=3.'
410=      PRINT *,
420=      READ *,GCCLEV
430=      PRINT *,
440=      PRINT *,
450=      PRINT *,'  WHAT IS THE EXPECTED ATTRITION RATE?'
```

```
460=      PRINT *,
470=      READ *,ATRATE
480=      IF(GCCLEV.EQ.1.)THEN
490=      RATEX=(516.-EXSQ)/DAYS
500=      RATIN=(612.-INEXSQ)/DAYS
510=      ELSEIF(GCCLEV.EQ.2.)THEN
520=      RATEX=(768.-EXSQ)/DAYS
530=      RATIN=(888.-INEXSQ)/DAYS
540=      ELSEIF(GCCLEV.EQ.3.)THEN
550=      RATEX=(984.-EXSQ)/DAYS
560=      RATIN=(1128.-INEXSQ)/DAYS
570=      ELSE
580=      ENDIF
590=      EXSORT(1)=6.6966667-.076666667*ATRATE
600=      EXSORT(2)=8.1366667-.11533333*ATRATE
610=      EXSORT(3)=8.6433333-.095333333*ATRATE
620=      EXSORT(4)=10.066667-.14533333*ATRATE
630=      EXSORT(5)=11.723333-.19533333*ATRATE
640=      INSORT(1)=6.7133333-.082666667*ATRATE
650=      INSORT(2)=7.8266667-.10466667*ATRATE
660=      INSORT(3)=9.0266667-.12933333*ATRATE
670=      INSORT(4)=9.94-.144*ATRATE
680=      INSORT(5)=10.916667-.15533333*ATRATE
690=      DO 10 I=1,5
700=      X=X+1.
710=      IF(RATEX.LE.EXSORT(I))THEN
720=      Y=EXSORT(I)
730=      GO TO 20
740=      ELSE
750=      ENDIF
760=10    CONTINUE
770=20    PRINT 100,RATEX
780=100   FORMAT(//10X,' EXP SORTIE RATE NEEDED = ',10X,F10.8)
790=      PRINT 200,X
800=200   FORMAT(//10X,' EXPERIENCED SORTIE LEVEL = ',5X,F4.2)
810=      PRINT 300,Y
820=300   FORMAT(//10X,' EXP SORTIE RATE ACHIEVED = ',10X,F10.8)
830=      X=0.
840=      Y=0.
850=      DO 30 I=1,5
860=      X=X+1.
870=      IF(RATIN.LE.INSORT(I))THEN
880=      Y=INSORT(I)
890=      GO TO 40
900=      ELSE
910=      ENDIF
920=30    CONTINUE
930=40    PRINT 400,RATIN
940=400   FORMAT(//10X,' INEX SORTIE RATE NEEDED = ',10X,F10.8)
950=      PRINT 500,X
960=500   FORMAT(//10X,' INEXPERIENCED SORTIE LEVEL = ',5X,F4.2)
```

```
 970=      PRINT 600,Y
 980=600   FORMAT(//10X,' INEX SORTIE RATE ACHIEVED = ',10X,F10.8)
 990=      PRINT *,
1000=      PRINT *,
1010=      PRINT *,'  CHOOSE THE HIGHER OF THE TWO SORTIE LEVELS'
1020=      PRINT *,'  FOR THE OPTIMUM SORTIE LEVEL. IF THEY ARE EQUAL'
1030=      PRINT *,'  THEN USE THAT LEVEL.'
1040=      STOP
1050=      END
```

```
%RUN- LCO
THIS PROGRAM IS DESIGNED TO CALCULATE
THE MOST EFFICIENT SORTIE RATE TO ACHIEVE
A PREDETERMINED CCC LEVEL.

 HOW MANY DAYS REMAIN IN THE CYCLE?
   60.                                  EXP SORTIE RATE NEEDED =          5.30000000

 ENTER ACCOMPLISHED EXPERIENCED SORTIES EXPERIENCED SORTIE LEVEL =      1.00
  450.

  ENTER ACCOMPLISHED INEXPERIENCED SORTIE  EXP SORTIE RATE ACHIEVED =          5.77666670
  430.

                                        INEX SORTIE RATE NEEDED =          7.63333333
 WHAT CCC LEVEL DO YOU DESIRE?
 REMEMBER THAT A=1.,B=2.,C=3.
  2.                                    INEXPERIENCED SORTIE LEVEL =      4.00

 WHAT IS THE EXPECTED ATTRITION RATE?   INEX SORTIE RATE ACHIEVED =          8.21200000
   12.

                                       CHOOSE THE HIGHER OF THE TWO SORTIE LEVELS
                                       FOR THE OPTIMUM SORTIE LEVEL. IF THEY ARE EQUAL
                                       THEN USE THAT LEVEL.
```

Interactive Model Variables

Variables	Description
ATRATE	Forecasted Attrition Rate
DAYS	Flying Days Remaining
EXSQ	Experienced GCC Sorties
INEXSQ	Inexperienced GCC Sorties
GCCLEV	Desired GCC Level
RATEX	Needed Experience Rate
RATIN	Needed Inexperienced Rate
EXSORT (5)	Experienced Sorties Array
INSORT (5)	Inexperienced Sorties Array
X	Exp/Inexp Sortie Level Needed
Y	Exp/Inexp Sortie Rate

Appendix K

Attrition Test

For each of the tests the following procedure was used:

$$T = \frac{\bar{X} - \mu}{S / \sqrt{n}} \; ; \; \nu = n-1$$

Reject H_0 if $T < -t_{\alpha/2}$ or $T > t_{\alpha/z}$

where $\alpha = .01$, $n = 300$

$t_{.005,59} \simeq 2.576$

<u>For 10% attrition and 14 sorties/day</u>

$\mu = 12.6$

$\bar{X} = 12.65$

$S = .9536$

$T = .908$

do not reject H_0

<u>For 12.5% attrition and 16 sorties/day</u>

$\mu = 14.0$

$\bar{X} = 14.05$

$S = 1.395$

$T = .621$

do not reject H_0

For 15.0% attrition and 18 sorties/day

$\mu = 15.3$

$\bar{X} = 15.083$

$S = 1.565$

$T = 2.40$

do not reject H_0

For 17.5% attrition and 20 sorties/day

$\mu = 17.6$

$\bar{X} = 16.3$

$S = 1.853$

$T = 1.869$

do not reject H_0

For 20.0% attrition and 22 sorties/day

$\mu = 17.6$

$\bar{X} = 7.467$

$S = 1.692$

$T = 1.362$

do not reject H_0

The data that follows was used in the testing of sample means for verification of attrition.

100= 14
110= 12
120= 13
130= 13
140= 13
150= 13
160= 13
170= 14
180= 13
190= 12
200= 12
210= 14
220= 12
230= 11
240= 11
250= 11
260= 12
270= 13
280= 13
290= 12
300= 12
310= 13
320= 10
330= 14
340= 13
350= 14
360= 11
370= 13
380= 11
390= 12
400= 13
410= 12
420= 12
430= 14
440= 13
450= 13
460= 13
470= 14
480= 13
490= 12
500= 13
510= 13
520= 13
530= 13
540= 14
550= 10
560= 13
570= 14
580= 13
590= 12
600= 13
610= 13
620= 13
630= 13
640= 13
650= 12
660= 12
670= 13
680= 13
690= 13
700= 15
710= 14
720= 13
730= 15
740= 15
750= 15
760= 15
770= 16
790= 14
790= 16
800= 13
810= 15
820= 15
830= 15
840= 13
850= 13
860= 15
870= 16
880= 15
890= 13
900= 13
910= 15
920= 13
930= 14
940= 14
950= 12
960= 14
970= 13
980= 14
990= 16
1000= 15
1010= 15
1020= 12
1030= 14
1040= 15
1050= 12
1060= 12
1070= 15
1080= 11
1090= 10
1100= 13
1110= 15
1120= 16
1130= 15
1140= 15
1150= 15
1160= 13
1170= 13
1180= 15
1190= 13
1200= 14
1210= 12
1220= 15
1230= 14
1240= 14
1250= 16
1260= 12
1270= 16
1280= 15
1290= 12
1300= 17
1310= 16
1320= 15
1330= 13
1340= 15
1350= 15
1360= 12
1370= 14
1380= 16
1390= 16
1400= 14
1410= 14
1420= 16
1430= 13
1440= 15
1450= 17
1460= 17
1470= 14
1480= 16
1490= 14
1500= 14
1510= 16
1520= 10
1530= 16
1540= 16
1550= 14
1560= 18
1570= 17
1580= 13
1590= 16
1600= 13
1610= 15
1620= 12
1630= 17
1640= 13
1650= 14
1660= 14
1670= 16
1680= 15
1690= 13
1700= 14
1710= 15
1720= 15
1730= 16
1740= 13
1750= 15
1760= 16
1770= 12
1780= 16
1790= 17
1800= 17
810= 14

1820= 15
1830= 16
1840= 16
1850= 16
1860= 17
1870= 15
1880= 16
1890= 13
1900= 18
1910= 16
1920= 16
1930= 14
1940= 13
1950= 16
1960= 19
1970= 13
1980= 17
1990= 14
2000= 13
2010= 15
2020= 17
2030= 18
2040= 19
2050= 18
2060= 16
2070= 14
2080= 13
2090= 17
2100= 14
2110= 17
2120= 13
2130= 18
2140= 17
2150= 17
2160= 17
2170= 15
2180= 16
2190= 18
2200= 19
2210= 14
2220= 15
2230= 18
2240= 18
2250= 15
2260= 19
2270= 19
2280= 14
2290= 18
2300= 17
2310= 16
2320= 13
2330= 15
2340= 16
2350= 18
2360= 13
2370= 15
2380= 18
2390= 19
2400= 17
2410= 15
2420= 16
2430= 19
2440= 16
2450= 17
2460= 15
2470= 16
2480= 17
2490= 16
2500= 20
2510= 20
2520= 17
2530= 16
2540= 16
2550= 19
2560= 17
2570= 20
2580= 15
2590= 19
2600= 17
2610= 19
2620= 19
2630= 14
2640= 21
2650= 18
2660= 17
2670= 17
2680= 17
2690= 19
2700= 18
2710= 21
2720= 17
2730= 17
2740= 19
2750= 17
2760= 17
2770= 17
2780= 15
2790= 18
2800= 14
2810= 15
2820= 17
2830= 16
2840= 17
2850= 15
2860= 18
2870= 16
2880= 17
2890= 18
2900= 16
2910= 20
2920= 16
2930= 18
2940= 19
2950= 18
2960= 16
2970= 18
2980= 18
2990= 19
3000= 17
3010= 20
3020= 19
3030= 17
3040= 18
3050= 13
3060= 18
3070= 17
3080= 18
3090= 17

Vita

John P. Wood was born on 4 October 1950 in Maracay, Venezuela. He graduated from Sidney Lanier High School, Montgomery, Alabama in 1968 and then attended Auburn University. He was awarded a Bachelor of Science degree in Industrial Engineering and was commissioned in June 1972. After completion of navigator training he served in operational F-4 assignments in Okinawa, Taiwan, United Kingdom, Florida, and Korea. He entered the School of Engineering, Air Force Institute of Technology, in August 1980.

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During the course of a six-month training period, wing schedulers are tasked with revising their planned flying schedules. The objective of this research was to build an interactive model that would determine a sortie rate to allow one F-4E squadron to maintain a predetermined level of training.

A model of the flying operations of the squadron was constructed using the Q-GERT simulation language. This model

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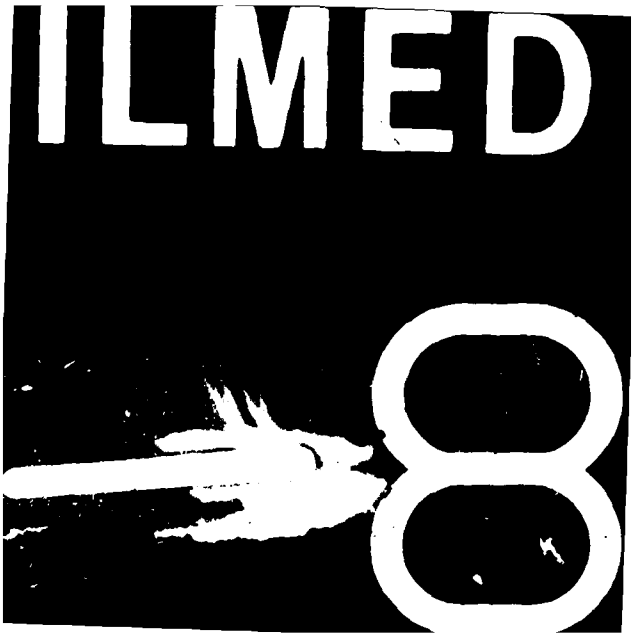
provided the data base for effective sorties flown by experienced and inexperienced pilots. Regression lines were constructed for both classes of pilots with attrition being the independent variable and effective sorties being the dependent variable. The regression coefficients were then incorporated into a model to evaluate sortie rates. The sortie rate obtained from the model is one that will allow the squadron to maintain at least the desired training level.

Although the squadron modeled in this project is not a real one, the approach presented could be used for actual fighter squadrons to help determine their projected daily sortie rates.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